MARYLAND

AT THE

LOUISIANA PURCHASE EXPOSITION

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THE MARYLAND STATE BUILDING

Ellicott & Emmart, Architects
Baltimore, Md.

REPORT

OF THE

MARYLAND COMMISSION

TO THE

LOUISIANA PURCHASE EXPOSITION

ST. LOUIS, MISSOURI, 1904

TO THE

GENERAL ASSEMBLY OF MARYLAND

SESSION, 1906

BALTIMORE, MD.
1906

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HON. DAVID R. FRANCIS
President "Louisiana Purchase Exposition"

THE COMMISSION'S WORK

ORGANIZATION
OFFICIAL CEREMONIES
AND
EXHIBITS

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GROUPS AND VIEWS.

ACT OF THE GENERAL ASSEMBLY OF MARYLAND OF THE SESSION OF 1902, CHAPTER 512

An Act to appropriate certain sums of money to the support of sundry schools for each of the two fiscal years ending on the 30th day of September, 1903, and the 30th day of September, 1904, respectively.

Section 74. To the Board of Commissioners hereby authorized to be appointed by the Governor on behalf of the State of Maryland to the St. Louis Exposition, the sum of $25,000, or so much thereof as may be necessary.

Approved April 11, 1902.

ACT OF THE GENERAL ASSEMBLY OF MARYLAND OF THE SESSION OF 1904, CHAPTER 56

An Act to appropriate the sum of forty thousand dollars for the use of the Commissioners appointed by the Governor, under the authority conferred upon him by the Act of 1902, to represent the State of Maryland at the St. Louis Louisiana Purchase Exposition, to be held at St. Louis, Missouri, in the year 1904.

Whereas, It is of great importance to this State and the credit of its citizens that it should be properly represented at the St. Louis Louisiana Purchase Exposition, to be held in the City of St. Louis, Missouri, in 1904; and,

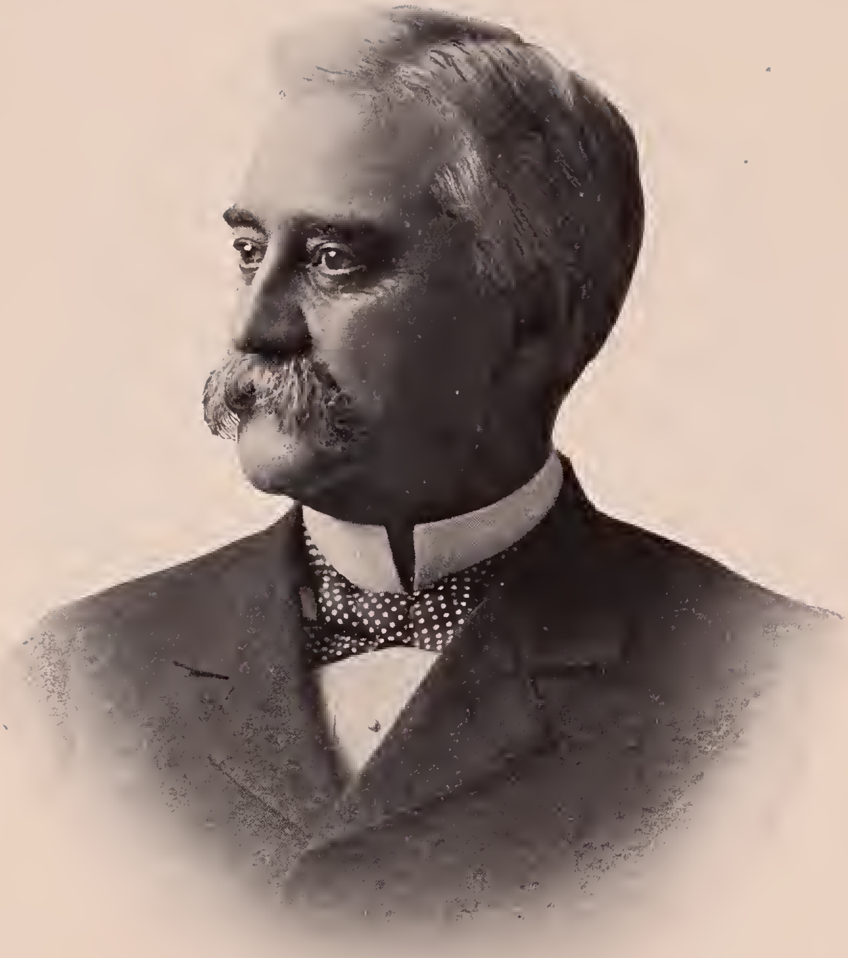
Whereas, The Commissioners appointed by the Governor to represent this State at said Exposition have given a great deal of time and attention to the duties devolving upon them, and find that the sum of twenty-five thousand dollars appropriated by the Legislature in 1902 will be totally inadequate to enable them to secure a proper display of the varied interests and industries of this State, believing as they do that it is of great importance that the natural resources, industrial development, agricultural interests, and general progress of the State of Maryland should be creditably displayed to the world at said Exposition, and that the commercial and business interests of the State can be greatly benefited by a larger appropriation for the purpose of having the State properly represented at said Exposition; and,

Whereas, Apart from the benefit that will inure to this State from a proper representation at said Exposition, a pardonable State pride is another reason why this State, occupying as it does such a conspicuous position in the galaxy of Southern States, should be prominently in evidence at St. Louis so as to contribute her share toward making the proposed Exposition a success; now, therefore,

Section 1. *Be it enacted by the General Assembly of Maryland,* That the sum of forty thousand dollars, or so much thereof as may be necessary for said Commission, is hereby appropriated, and the Comptroller of the State is hereby authorized and directed to draw his warrant on the Treasurer of this State for the payment of said requisitions to the extent of this appropriation, as may from time to time be made upon him by the said Commissioners, the said requisitions to be signed by the chairman of the said Commission and countersigned by their treasurer, to be accompanied by an estimate of the expenses to which the money so drawn is to be applied.

Section 2. *And be it enacted,* That this Act shall take effect from the date of its passage.

Approved March 9, 1904.



Photographed by Blessing and Fengé

HIS EXCELLENCY JOHN WALTER SMITH
Governor of Maryland, 1900-1904

MARYLAND COMMISSION AT THE LOUISIANA PURCHASE EXPOSITION

OFFICERS

CHAIRMAN,	L. VICTOR BAUGHMAN,	FREDERICK COUNTY.
VICE-CHAIRMAN,	FRANK N. HOEN,	BALTIMORE CITY.
TREASURER,	FREDERICK P. STIEFF,	BALTIMORE CITY.
SECRETARY,	SAMUEL K. DENNIS,	WORCESTER COUNTY.

COMMISSIONERS

MRS. MARIE A. FISHER, BALTIMORE CITY.
MRS. FRANCES E. LORD, BALTIMORE CITY.
L. VICTOR BAUGHMAN, FREDERICK COUNTY.
FRANCIS E. WATERS, BALTIMORE CITY.
WILLIAM A. MARBURG, BALTIMORE CITY.
FRANKLIN P. CATOR, BALTIMORE CITY.
HENRY J. McGRATH, BALTIMORE CITY.
WILLIAM H. GRAFFLIN, BALTIMORE CITY.
*WESLEY M. OLER, BALTIMORE CITY.
THOMAS H. ROBINSON, HARFORD COUNTY.
JACOB M. PEARCE, BALTIMORE COUNTY.
ORLANDO HARRISON, WORCESTER COUNTY.
FREDERICK P. STIEFF, BALTIMORE CITY.
FRANK N. HOEN, BALTIMORE CITY.

* Removed to New York City.

Photograph by Bachrach Bros.

GENERAL LLOYD L. JACKSON

President Merchants and Manufacturers' Association

LETTER OF TRANSMITTAL TO THE GENERAL ASSEMBLY OF MARYLAND

On behalf of the Maryland Commission to the Louisiana Purchase Exposition held to commemorate the purchase from France of the vast Louisiana Territory in the City of St. Louis, Missouri, April 30 to December 1, 1904, I have the honor to transmit herewith a report and statement of the work and financial disbursements of the Commission. This report may be criticised as partaking too much of the characteristics of a personal narrative and as being too long; but the very necessities of the case require that it deal almost exclusively with affairs of which your Commissioners are a part, and it is our duty to acquaint your Honorable Body fully and frankly with every detail of our work.

It is a source of satisfaction to the members of the Commission and a matter of congratulation, we trust, to the people of the State, that the number of exhibits made by the State was greater than at any previous Exposition or World's Fair, and what is of more importance, the exhibits were of a better class and of higher character. This report must deal, however, only with work done under the control of the State, and while it is gratifying to know of the success of private exhibitors, it is inappropriate to treat it here.

Notwithstanding the expense attendant upon the construction, furnishing, and maintenance of a State Building, the collection, installation, and maintenance of two separate exhibits of the size and character of the Geological and the Agricultural Exhibits, and participation in the official and State days of the Exposition, the Commission will return to the State Treasury an unexpended balance out of the total $65,000 State appropriation of about $1400.00.

Respectfully submitted,

L. VICTOR BAUGHMAN,

President Maryland Commission.

BALTIMORE, MARYLAND, *December 30, 1905.*

CHAPTER I.

THE BEGINNING OF MARYLAND'S EXHIBIT.

It is hard to point out the time when, or with whom, the idea of organizing an exhibit from Maryland first originated. The first step toward the accomplishment of that result was taken by General L. Victor Baughman, who visited St. Louis during the early part of the year 1902, and became thoroughly impressed with the necessity of Maryland being properly represented at the Louisiana Purchase Exposition, and convinced of the success of the Exposition and the courage, enterprise, and judgment of those in charge of the great Fair. Former residents of the State of Maryland, now living in the State of Missouri, as well as all the Exposition authorities, were most anxious that Maryland take an official part in the Exposition, as nearly every other State in the Union had agreed to do.

It was soon recognized that the people of our State as a whole were not fully acquainted with the grandeur and importance of the Exposition and the beneficial results to be had by advertising the State and her resources there. With a view to bringing the matter forcibly to the attention of the people and especially the business organizations, trades bodies, and the General Assembly of the State, General Baughman arranged with a number of former Marylanders to visit the State and appear before the General Assembly, then in session, in the interests of an exhibit from Maryland.

The following extracts taken from one of the Baltimore daily papers of February 18 and February 19 respectively of the year 1902 contain the first public notice of the movement, and also show that the commercial organizations of Baltimore, especially the Merchants and Manufacturers' Association, the Board of Trade, and the Old Town Merchants and Manufacturers' Association, with characteristic foresight and good judgment early recognized the opportunities for the advancement of the trade of the State offered by the Exposition, and gave the movement earnest, enthusiastic, and most efficient support. It is also worthy of note in passing that none of these organizations, nor any of their members, asked or received any financial assistance from the State in making exhibits, but nevertheless the Commission is under lasting obligations to them for the cordial and consistent support at all times accorded to it.

The extracts above referred to are as follows:

"February 18. With unadulterated Maryland hospitality the St. Louis delegates who are here to advocate the representation of the State at the Louisiana Purchase Exposition in that city next year were entertained yesterday afternoon at the Merchants' Club by a number of Baltimore's prominent business men, including the presidents of the Board of Trade, the Chamber of Commerce, and the Merchants and Manufacturers' Association. Mayor Hayes and Senator-elect Gorman were also there, and both declared themselves in earnest sympathy with the mission of the Committee from St. Louis. Other prominent personages spoke in a similar strain and it is proposed to have a large party accompany the St. Louisians to Annapolis to-day to advocate their cause before the General Assembly.

"All the visitors were formerly residents of Maryland. They are Messrs. Murray Carleton, of Allegany County, now president of the St. Louis Transit Company; Mr. William H. Thomson, of Frederick, Md., now cashier of the Boatmen's Bank of St. Louis; Mr. F. L. Ridgely, formerly of Baltimore, now a member of the St. Louis Park Commission; Mr. C. L. Hilleary of Frederick County, now assistant general passenger agent of the Big Four Railroad; Mr. F. J. McMaster, formerly of Worcester County, now a leading lawyer in St. Louis; and Mr. Leonard Matthews, formerly of Baltimore, now a capitalist in St. Louis.

"After a delightful luncheon short speeches explanatory of the visit of the Westerners and expressive of the sentiment which prevails here with regard to the matter were made by Gen. Lloyd L. Jackson, Mayor Hayes, Senator-elect Gorman, Mr. Carleton, Mr. McMaster, Gen. L. Victor Baughman, Mr. Wm. H. Thomson, Gen. Felix Agnus, and Mr. F. L. Ridgely.

Photograph by Ilgenfritz

J. GEORGE GEHRING, JR.

President Old Town Merchants and Manufacturers' Association

"Mr. Carleton said: 'The St. Louis Exposition will cost $30,000,000 and will occupy 1200 acres. The Paris Exposition occupied 336 acres. I say to you gentlemen who control the business and financial interests of Baltimore that as a business proposition you cannot afford to let this opportunity pass without Maryland being properly represented at the Exposition. Your manufactures, according to the census, amount to $242,000,000. Why not make the figure $442,000,000 in the next decade?'

"A telegram was received from Ex-Governor D. R. Francis, president of the Exposition, expressing regret that it was impossible for him to be here, was read. Among those present at the luncheon and meeting were:

"Messrs. Blanchard Randall, president of the Board of Trade; Lloyd L. Jackson, president of the Merchants and Manufacturers' Association; C. C. Macgill, president of the Chamber of Commerce; H. A. Parr, E. Stanley Gary, Wesley M. Oler, State Treasurer Murray Vandiver, J. Hillen Jenkins, Ex-Mayor F. C. Latrobe, Major Fred. Brackett, State Senator Johnzie Beasman, R. M. Sutton, G. W. Knapp, Summerfield Baldwin, Edwin Warfield, Col. Seymour Mandelbaum, Herman Stump, Robert Taylor, Robert Ramsay, Lawrence B. Kemp, Daniel E. Conklin, Clarence H. Forrest, J. Marian Ebberts, Joseph R. Foard, H. Crawford Black, W. H. Matthai, Nelson Perin, Charles Goldsborough, Andrew D. Jones, Washington Bowie, and George A. Von Lingen.

"Last evening the visitors were entertained at the theater. This morning they all go to Annapolis on a special car leaving Camden Station at 8.55 o'clock and returning from there at 3.10 p. m."

February 19, 1902: "The St. Louis delegates who have come to Maryland to urge the Legislature to provide a suitable exhibit for this State at the Louisiana Purchase Exposition next year appeared with a representative committee of Marylanders before the Legislature in the House of Delegates this morning and presented their case.

"The House was crowded and the speeches, which were brief and few in number, were listened to attentively. The delegation did not name the specific amount which they want the Legislature to appropriate, but it was indicated that it should not be less than $100,000. A bill was subsequently introduced in the Senate appropriating this amount.

"After the hearing the entire delegation lunched at the Executive Mansion with Governor Smith and left Annapolis on the 3 o'clock train.

"The hearing was opened by Gen. L. L. Jackson, who stated the object of the visit of the delegation and urged the General Assembly to listen to the case of the visitors with liberal and broad minds. He said the growth of St. Louis had been largely due to Maryland men and added that every dollar spent by the State at the St. Louis Exposition would be returned threefold. In concluding he introduced Mr. Murray Carleton.

"Mr. Carleton said in part:

"'We come as the representatives of the greatest international exposition the world has ever known to extend an invitation to your great State to participate. We want a building to mark the spot set aside for Maryland on the great Fair grounds. We want the Maryland Exhibit to be among the most conspicuous in the galaxy of this great sisterhood of States; we want an outpouring of Maryland's patriotic sons and beautiful daughters to swell the pageant of our national greatness.

"'You have been richly endowed by nature, and by your industry and perseverance you have advanced to a position of great magnitude in the commercial development of the Union, and you owe a duty to yourselves, to your constituents, and to your country to show the enlightened nations what you have accomplished.

"'I said a moment ago that this will be the greatest Exposition the world has ever seen. I repeat it with the addition that this great enterprise, projected on a plan and scope that will make it nearly twice as big (and I use the word big in its most comprehensive sense) as any previous international exposition.

"'The Legislature should make an appropriation sufficiently liberal to admit of a creditable and comprehensive exhibit of her resources. Your exhibit should be a most splendid affair, and in doing this you will not only aid in the development of the material resources of the State, but you will uphold the hands of the National Government, in bringing forcibly to the notice of the nations of the earth the unrivaled precedence of America as a financial, commercial, and manufacturing people.'

"Congressman Joy was the second speaker. He said Missouri was really a Southern State and Maryland would have a far better chance in St. Louis than at Chicago. He urged upon the General Assembly to give to Maryland an exhibit in St. Louis of which the whole State would be proud. He did not see, he said, how a fair showing could be made on less than $100,000.

"General Jackson thanked the Senators and Delegates for the courteous hearing accorded, and asked favorable consideration of the bill to be introduced.

"The bill which was introduced in the Senate by Senator Bryan, provides for an appropriation of $100,000 and for a commission of ten, to be styled the St. Louis Louisiana Purchase Commission, of which the Governor is to be chairman ex-officio. This commission is to have charge of all moneys appropriated for the Exposition and arrange for and carry into effect all necessary means for the proper and fitting representation of Maryland at St. Louis in 1903, with full authority and power to expend the money appropriated, so as to produce the best possible results to this State.

"The St. Louis delegation was composed of Messrs. William H. Thomson, C. L. Hillcary, F. J. McMaster, Congressman Charles F. Joy, Leonard Matthews, Murray Carleton, and F. L. Ridgely.

"The Marylanders acting as a committee of escort to Annapolis included General L. L. Jackson, General L. Victor Baughman, Messrs. Charles C. MacGill, E. Stanley Gary, Lawrence B. Kemp, General Thomas S. Mumford, Andrew D. Jones, Robert Taylor, J. Hillen Jenkins, Col. Charles Goldsborough, Major Frederick W. Brackett, Clarence H. Forrest, W. H. Matthai, and James E. Ingram, Jr."

The bill referred to in the last article and introduced by Senator Olin Bryan of Baltimore City appropriating $100,000 for a Maryland Exhibit at the Louisiana Purchase Exposition met with determined opposition in the State Senate, but eventually passed that body and was sent to the House of Delegates, where it was referred to the Ways and Means

Photograph by Perkins

CHARLES C. MACGILL
President Chamber of Commerce

Committee, and finally brought out with an unfavorable report by that committee, which was composed of Messrs. Rogers of Howard County. chairman; Campbell, Linthicum, Dirickson, Mattingly, Rogers of Baltimore County, Sellman, Dryden, and Foutz. Mr. Wm. F. Broening of Baltimore City endeavored to save the life of the measure in the House by moving that the bill be substituted for the unfavorable report, but his motion was defeated by a vote of eighty-five to five, and the bill, as well as the hopes of those who deemed it wise and expedient for the State to take her proper place along with the other progressive States of the Union and foreign nations, seemed to be effectually killed.

However, a number of the prominent business men of Baltimore while disappointed were not disheartened, and the fight was not abandoned as the following extract taken from the Baltimore *Sun* of March 12, 1902, shows:

"A delegation of Baltimore business men including Clarence H. Forrest, Secretary of the Merchants and Manufacturers' Association, Mr. Charles Goldsborough, Mr. Frank N. Hoen, and others asked the committees for an appropriation for Maryland Day at the Charleston Fair and for $50,000 for the St. Louis Fair. Mr. Hoen said that in the enthusiam following the visit of the St. Louis committee a bill for $100,000 had been introduced. The bill had been defeated and it is now believed that the State can be properly represented for $50,000 and that sum is asked."

The appropriation of $50,000, which was finally incorporated in the General Appropriation Bill was bitterly fought by the same people who assisted in killing the first bill introduced by Senator Bryan making an appropriation of $100,000 for the Exposition, and the amount was reduced to $40,000 and finally that sum was cut down to $25,000 in the House of Delegates. After a prolonged and determined fight the General Appropriation bill was finally passed on March 27, 1902, carrying an appropriation of $25,000 to the "St. Louis Commissioners, hereafter to be appointed by the Governor."

The Act of the General Assembly of 1902 appropriating $25,000 was never regarded by the interests advocating an appropriate and proper

BLANCHARD RANDALL
President Board of Trade

exhibit as conclusive or satisfactory; and during the next two years the campaign for a supplemental appropriation was never abandoned. Your Commissioners found an additional incentive to press the matter in the views expressed by the farmers of the State, particularly at a meeting of the Farmers' Clubs, held at the Maryland Agricultural College in May, 1903, and at the Carrollton Hotel on September 2, 1903, that $60,000 would be required for an agricultural exhibit alone; as the following newspaper report of the latter meeting shows:

"A determination to go before the next Legislature and ask for an appropriation of $60,000 in addition to the $25,000 already allowed for an exhibit of the agricultural interests of Maryland at the St. Louis World's Fair was arrived at yesterday at a meeting at the Carrollton Hotel of a number of leading men from the different counties. The meeting preceded one in the interests of good roads and nearly all who attended that gathering were present and urged the request for more money to show off Maryland's resources in the way of farming at the Exposition.

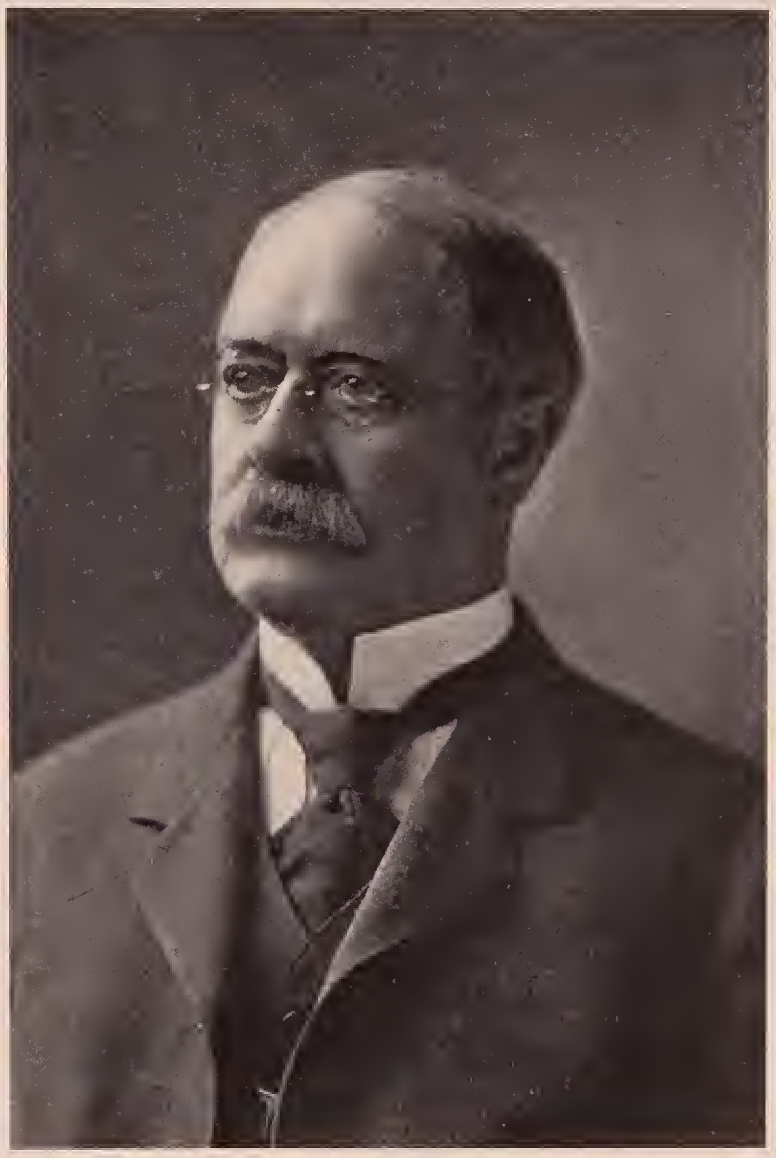
"About a year ago there was a gathering of farmers at the Maryland Agricultural College to discuss the project, and the date for yesterday's meeting was then set. Mr. Samuel M. Shoemaker, who presided at the roads meeting, was chairman, and Mr. Weems was secretary of the first meeting.

"Those who have been studying the needs of the exhibit stated they had concluded that immense good would be done the State if the showing made would equal that made in the mining exhibit at Buffalo, and after a careful figuring it was found that $60,000 was the amount needed."

The Old Town Merchants and Manufacturers' Association endorsed the supplemental appropriation by the following resolution:

"The following preamble and resolutions were adopted by the Board of Governors of the Old Town Merchants and Manufacturers' Association at a special meeting held Wednesday, January 27, 1904:

"*Whereas,* The Louisiana Purchase Exposition which is to be held in the City of St. Louis, May to November of this year, is expected to be the greatest and most complete exhibition the world has ever seen of the wonderful resources of the United States and foreign countries, and which



Photograph by Bachrach

COL. WILLIAM H. LOVE
Secretary Board of Trade

will demonstrate the extraordinary progress that has been made in the Arts and Sciences; Manufactures, Agricultural and other interests of the world, and

"*Whereas,* With few exceptions the various States and Territories have made ample arrangements for fine State Buildings (which become headquarters for their citizens while at the Exposition) and where excellent exhibits of their resources will be displayed, and

"*Whereas,* The State of Maryland, which has always occupied a prominent and important part in the history of our country and which has such great commercial, manufacturing, agricultural and mining interests; and which occupies such a commanding location on the Atlantic Seaboard, should be properly represented at the said Louisiana Purchase Exposition, therefore be it

"RESOLVED, That the Board of Governors of the Old Town Merchants and Manufacturers' Association respectfully petition the General Assembly of Maryland to pass the measure now pending before it to appropriate not less than sixty thousand dollars, so that the Maryland Commissioners to the Louisiana Purchase Exposition may be enabled to erect a suitable building and arrange such an exhibit of our resources as shall be a credit to our grand old State.

"RESOLVED, That a copy of these resolutions be forwarded to the members of the General Assembly and that the President appoint a special committee to co-operate with the Maryland Commissioners to said Exposition in their efforts to secure said appropriation.

J. GEO GEHRING, JR., *President.*

JOHN W. MARSHALL, *Secretary.*"

On February 1, 1904, the Board of Trade of Baltimore adopted resolutions urging the Legislature to make an additional appropriation for a State Building at the Louisiana Purchase Exposition. A committee was appointed to join similar committees from other business organizations to ask the House and Senate for the appropriation.

The Committee consisted of Messrs. C. C. Macgill, Franklin P. Cator, Daniel C. Ammidon, Ernest Knabe, Samuel Eccles, Jr., and Col. William H. Love.

The visit of the committee and others to Annapolis in behalf of the appropriation can be best described by reproducing the impartial newspaper report thereof.

"Annapolis, *Feb. 2, 1904*.—General L. Victor Baughman and the other members of the St. Louis Exposition Commission of Maryland, with a large delegation of representative citizens, came to Annapolis this morning, and after the session of the Legislature, appeared before the Ways and Means Committee of the House and the Finance Committee of the Senate, advocating the immediate passage of the bill already introduced, appropriating an additional $60,000, in order that Maryland may be fittingly represented at the Exposition.

"The delegation assembled in the hall of the House of Delegates and General Baughman made an eloquent appeal to the members of the two committees. He recited the fact that the last Legislature had appropriated $25,000, but that the Commission, after diligently and zealously working, had come to say that it was impossible to meet the requirements or to enable the state to make any showing at all that would not be humiliating to the pride of every citizen, with the money at hand. He said that Maryland must, if represented at all, compete with other States in the Union whose Legislatures had appropriated on the average of $100,000 for their exhibits. He said that unless this bill is passed at once it would be useless for the Commission to continue its efforts to reflect credit upon the State by its building and exhibits at the Fair, and he asked that some way be found by the Legislature for suspending its rules and making appropriation immediately.

"The site secured by the Maryland Commission, General Baughman declared, was one of the choice ones of the whole Exposition, and if granted this additional appropriation the Commission proposed to erect upon this site a duplicate of the State Building at the Charleston Exhibition, which he thought would gratify every true Marylander and reflect credit upon the State.

MAGNITUDE OF THE EXPOSITION.

"'My agricultural friends,' General Baughman said, 'will appreciate the wonderful magnitude of this great undertaking when I inform them that the area of the St. Louis Fair is 1240 acres. Chicago's great fair comprised 643 acres. The space under roof is 128 acres. Chicago had but 82. The appropriation by the States and Territories at St. Louis amounts already to $6,749,986, with the assurances of $8,000,000 more. Chicago had in all but $5,400,000.

"'The foreign buildings and other gardens occupy three times the space for like purposes at Chicago. There will be thirty-seven independent foreign governments and sixteen colonial governments which have already made appropriations of $7,017,250. Independent of these, several European cities have separate exhibits, including Paris and Berlin.

"'St. Louis has subscribed $5,000,000; the State of Missouri has subscribed $5,000,000; the Congress of the United States has appropriated $5,000,000 and General Francis, with the committee of the Louisiana Purchase Exposition, is now in Washington asking for an additional appropriation of $5,000,000 to complete this wonderful exposition.

"'Already forty-two buildings of States and Territories and possessions of the United States are in course of erection. There are over thirty foreign buildings, including pavilions of all the principal countries of the world.'

OTHERS URGING THE BILL.

"Others who urged the appropriation were Messrs. Jacob W. Hook of the Old Town Merchants and Manufacturers' Association; Charles C. Macgill of the Board of Trade; Reuben Foster of the Merchants and Manufacturers' Association, and Samuel M. Shoemaker representing the agricultural interests. All these gentlemen argued that the Legislature should lose no time in making this appropriation and declared that without it Maryland could not be properly represented at the Fair.

"Members of the Commission present were General L. Victor Baughman, Jacob M. Pearce, General Francis E. Waters, Henry J. McGrath,

CLARENCE H. FORREST
Secretary Merchants and Manufacturers' Association

Frederick P. Stieff, Frank N. Hoen and Mrs. Parks Fisher. Others in the delegation were Messrs. N. Winslow Williams, D. C. Ammidon, Franklin P. Cator, Colonel William H. Love, General Lloyd L. Jackson, Clarence H. Forrest, General J. McKenny White, Frederick H. Gottlieb, J. Albert Hughes, E. K. Pattison, Robert L. Rhodes, Thomas C. Ruddell, Charles Sutton, William T. Lyons, J. Hough Cottman, Dr. W. H. DeCourcey of Queen Anne's County and John G. Gehring, Jr.

TO INCREASE MARYLAND'S FAME.

"The bill which the Commission and Delegation is urging is strongly indorsed by the agricultural interests of the State and Farmers' Clubs and more than twenty counties have recommended its immediate passage, inasmuch as the Commission has declared its purpose of making the agricultural exhibit from Maryland one of the chief features of the display from this State. Already, General Baughman told the committee, $5000 had been set apart for this feature, and when completed it will be a revelation to the citizens of this as well as other States. Earnest appeals were made by different members of the Delegation to the Committee members and so far as has appeared, there is no opposition to the bill which is strongly indorsed by practically all of the trade organizations in Baltimore.

"The Delegation came to Annapolis in a special car, and returned this afternoon convinced that the bill will be passed. Senator Robinson, chairman of the Finance Committee, is a member of the Commission.

"In order to erect the Maryland building in time for the opening of the Fair it is necessary to have the additional appropriation at once. September 12 has been set apart, it was stated, as Maryland Day at the Fair and it is the intention of the Commission to make the day a memorable one. If they are enabled to carry out their plans, General Baughman stated, the showing made by Maryland at the Exposition will be second to no other State."

While the bill making the supplemental appropriation was being considered in the Senate the people of the State were appalled by the terrible Baltimore fire of February 7-8, 1904.

For a time the thoughts of the members of the General Assembly were engrossed in devising measures of relief for the City, which properly had the right of way over all other legislation. Apparently the supplemental appropriation bill had received its death blow, and it seemed an impossible task to bring the public or a majority of the General Assembly to a realization of the opportunity to show to the world, and especially our competing sister states and cities, that while unfortunate we were not discouraged, nor at the end of our resources, public or private, by going right on with our exhibit at the Exposition. The very fact of our having any exhibit, and particularly a creditable one, after such a public disaster, would bring us more prominence than a much more elaborate exhibit organized under normal conditions, and would reflect more credit on the courage and enterprise of our people.

After much labor and many trials and discouragements too tedious to mention, this view at length prevailed; and largely through the efforts of Senator Robinson, Chairman of the Finance Committee of the Senate, and Hon. E. E. Goslin, Chairman of the Ways and Means Committee of the House, a bill carrying an appropriation of $40,000, after many vicissitudes was finally passed and was promptly approved by the Governor on the 9th day of March, 1904.

CHAPTER II.

Organization of the Commission.

No guide was furnished the Governor, nor was any limitation or direction of any kind laid upon him, in the Act of 1902 making the appropriation of $25,000 as to the number or qualifications of the Commissioners to be appointed by him. Neither did the Act prescribe the duties, powers, or tenure of office of the Commissioners themselves.

His Excellency, Hon. John Walter Smith, the then Governor, therefore in the exercise of his own discretion as to the number of Commissioners and their qualifications, on the 25th of February, 1903, appointed the following gentlemen as Commissioners on the part of the State of Maryland to the Louisiana Purchase Exposition:

General L. Victor Baughman of Frederick County, Mr. John E. Hurst, General Francis E. Waters, Mr. William A. Marburg, Mr. William H. Grafflin, Mr. Wesley M. Oler, Mr. Martin Wagner, Mr. Frederick P. Stieff and Mr. Frank N. Hoen, all of Baltimore City, Hon. Thomas H. Robinson of Harford County, Mr. Jacob M. Pearce of Baltimore County, and Mr. Orlando Harrison of Worcester County. On December 18, 1903, Governor Smith appointed two ladies, Mrs. Marie A. Fisher and Mrs. Frances E. Lord, both of Baltimore City, as additional members of the Commission.

The Commissioners appointed by His Excellency, Governor Smith, all qualified, and held their first meeting in the rooms of the Merchants and Manufacturers' Association in Baltimore City. The Commission organized by electing as officers, General L. Victor Baughman of Frederick County, Chairman, Mr. John E. Hurst of Baltimore City, Vice-Chairman; Mr. Frederick P. Stieff of Baltimore City, Treasurer; and Mr. Samuel K. Dennis of Worcester County, Secretary.

All subsequent meetings were held at the office of the State Board of Public Works in the Merchants' Bank Building, Baltimore, until that

Photograph by Otto Sarony Co.

GEN. L. VICTOR BAUGHMAN
Chairman Maryland Commission

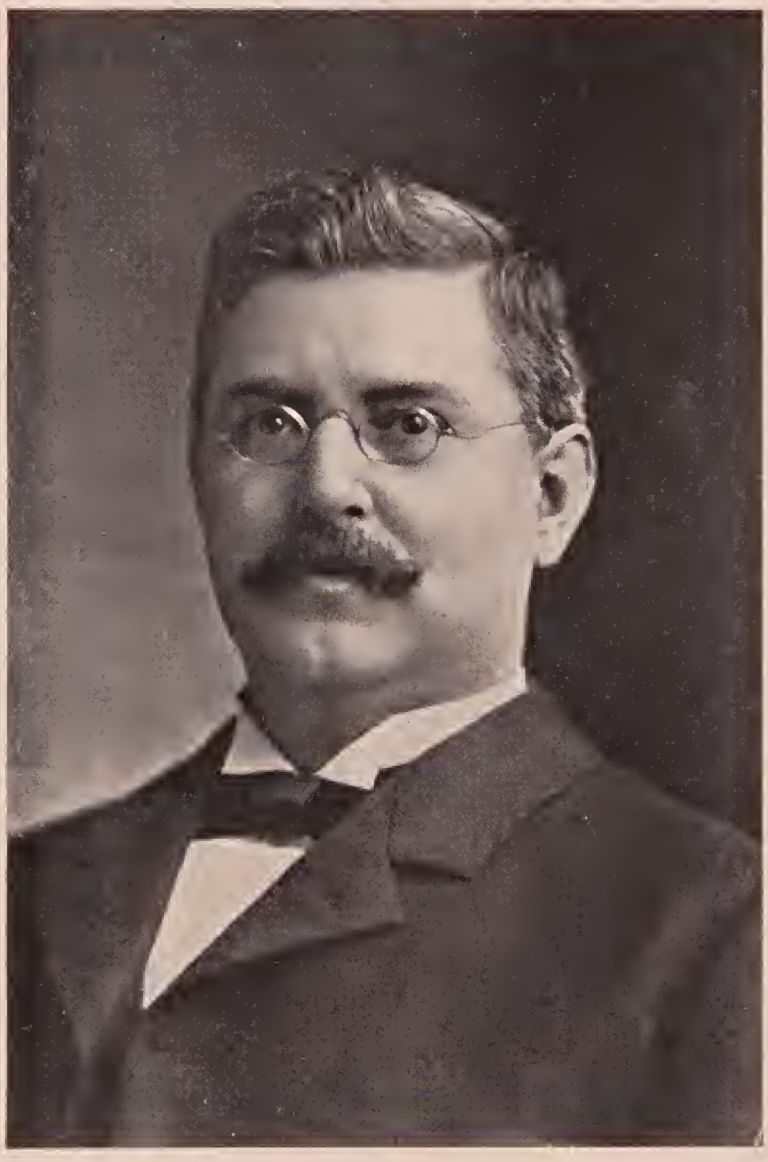
building, along with many of the books and records of this Commission was destroyed in the great fire of February 7-8, 1904. Afterward, through the courtesy of General Francis E. Waters, a member of the Commission, the meetings were held in his offices in the Builders' Exchange Building.

Your Commissioners were shocked and grieved by the death of the Vice-Chairman, Mr. John E. Hurst, which occurred on the 6th day of January, 1904, and came almost without warning to us, as his end was preceded by a very short illness and it was not generally known that his condition was serious.

Your Commissioners were previously called upon to mourn the loss of an associate in the death of Mr. Martin Wagner, who expired on the 28th day of December, 1903.

The memory of these two well known men is so fresh in the minds of the public as to make it superfluous for your Commissioners to advert to their noble, useful lives, nor could we hope to succeed in paying any just and adequate tribute to those extraordinary qualities of character and heart that endeared them to us.

The places thus made vacant on the Commission were filled by the appointment of Mr. Henry J. McGrath of Baltimore City on the 6th of January, 1904, by His Excellency Governor John Walter Smith, and by the appointment of Mr. Franklin P. Cator of Baltimore City on the 2d day of February, 1904, by His Excellency, Governor Edwin Warfield; Mr. Frank N. Hoen was elected Vice-Chairman of the Commission in the stead of Mr. John E. Hurst.



Photograph by Bachrach Bros.

FRANK N. HOEN
Vice-Chairman Maryland Commission

CHAPTER III.

The General Plan of the Maryland Commission.

The Commissioners organized at the first meeting, and found an available appropriation of $25,000, and a large field to be covered. The great danger lay in trying to attempt too much and thereby fritter away the State appropriation without accomplishing anything worthy of the State or the Exposition. It was manifestly impossible to aid all the industries of the State in making exhibits at the Exposition, and it would have been invidious for your Commission to elect to aid some and refuse to aid others, since all could justly urge an equal right to assistance. Your Commissioners were ambitious to do well all they might undertake, but the danger of undertaking too much, and the inevitable and consequent failure was always in mind. We were fortunate in having as a guide the experience acquired at the Chicago, Buffalo, and Charleston Expositions, and the advice of those who managed the Maryland Exhibits at those three great Fairs.

It was early and fully realized by your Commissioners that the St. Louis Exposition, the greatest of all Expositions, should, and like its predecessors, could, be properly used as a vehicle for the purpose of conveying accurate information regarding our State, her climate, her soil, her mineral wealth, and her commercial and social advantages and importance to the people of the world. The principal value of a great exposition lies in the fact that it is a superb advertising medium. Your Commissioners also learned from the experience gained at Chicago and Charleston, where the State maintained comfortable and creditable State buildings which ministered much to the comfort and convenience of thousands of Marylanders who visited those two Expositions, that a modest though comfortable and tasteful State building was a prime necessity.

The disadvantages and resultant inconvenience of not having a State

Photograph by Ashman

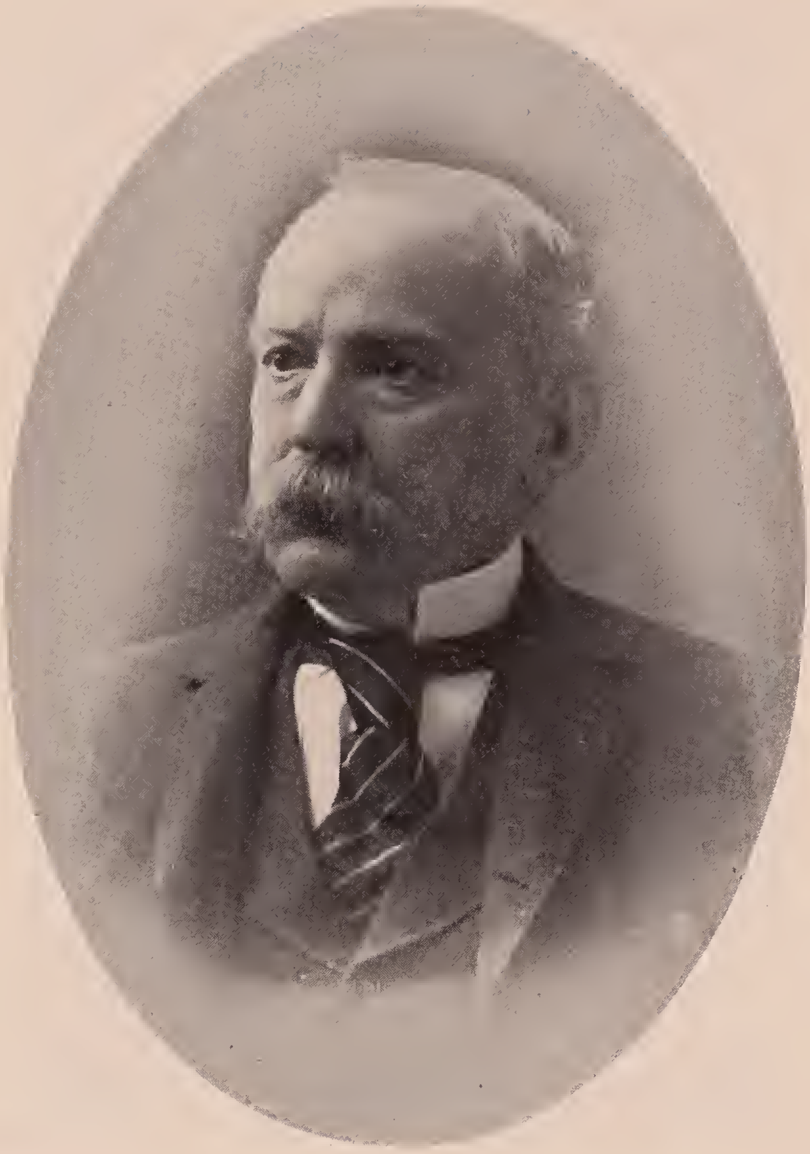
FREDERICK P. STIEFF
Treasurer Maryland Commission

building was borne upon your Commission by privations imposed upon our own people at the superb Buffalo Exposition, where our State was most creditably represented by Exhibits and the number of visitors, but was without any building a Marylander could call his own.

It was therefore early determined by your Commissioners to center their efforts especially on the exploitation of the mineral and agricultural products of Maryland, the two basic natural resources from which are drawn the supply of wealth and prosperity of the State, and two fields in which Maryland stands easily among the foremost; then if possible provide a home for Marylanders and others at the Fair. Your Commission felt that if Maryland's mineral and agricultural advantages could be properly set before the people of the world at the Exposition, that brains and capital would be attracted here to an extent which must make for the prosperity and development of every industrial and commercial branch, and thereby accomplish the fairest as well as the most thorough and far reaching benefit which could be had from the expenditure of the public moneys.

With two deviations this original plan was strictly adhered to. Your Commissioners aided the Johns Hopkins Nurses School Exhibit by an appropriation of $700 and an Exhibit of plaster surgical casts for deformed children. Neither of these exhibits were made for pecuniary gain but in the interests of general culture and humanity. Your Commissioners feel that the publicity given these exhibits and the benefits received amply compensate the public for the modest sum expended, and that more might have been profitably spent in the same way. The Johns Hopkins Nurses School Exhibit was in charge of Miss Hampson, and the surgical plaster cast Exhibit was in charge of Miss Barnwell.

It was absurd, however, with but $25,000 at our command to consider the possibility of making any sort of display representative of our mineral and agricultural riches, or in harmony with the grandeur and dignity of the Exposition and erect a State Building as well. Your Commission was consequently forced to hold all plans for a building in abeyance until further aid was received from the General Assembly of 1904; and was also forced to formulate an elastic scheme for the geologi-



Photograph by Bachrach Bros.

JOHN E. HURST
Vice-Chairman Maryland Commission
Died January 6, 1904

cal and agricultural exhibits, since the original appropriation was inadequate to meet the contingent necessary expenses of the Commission and the cost of the two principal exhibits.

Mr. William L. Amoss, a practical farmer of Harford County, and Director of Farmers' Institutes of the State of Maryland, was early placed in charge of the collection and installation of the Agricultural Exhibit. It was the original purpose of your Commission to have a horticultural exhibit as well as a distinctively agricultural exhibit. The expense of the undertaking was too great, and the plan, which had progressed somewhat, had to be reluctantly abandoned. However an opportunity was afforded at the Maryland Day Celebration to show what a degree of perfection fruit growing has attained in Maryland. A special Exhibit of Maryland grown peaches, apples, and pears was made on that occasion. Invitations were extended to many fruit growers of the State to contribute fruit and some responded. The Chairs Choice, a Maryland variety of peaches excited the most favorable comment. Many baskets of splendid fruit were given away to visitors and friends on Maryland Day, and each separate peach was carefully encased in a wrapper, telling where it was grown.

Dr. William Bullock Clark, State Geologist and Professor of Geology at the Johns Hopkins University generously and patriotically offered the magnificent aggregation of geological specimens collected under his supervision to the Commission. His offer was gratefully accepted, and he was also induced to assume charge of the Geological Exhibit. Ably assisted by Professor E. B. Mathews, also of the Johns Hopkins University, Dr. Clark devoted himself with energy and enthusiasm for months to the preparation and installation of the great mineral exhibit, which it is conceded was the most notable and successful feature of our participation in the Exposition. He asked no pay and received no reward, unless it be that he was rewarded by the sense of difficult duty well done, and the thanks of an appreciative people.

Your Commission had assigned to it a most eligible site for a State building, but until the Legislature of 1904 relieved our financial embarrassment to an extent by making an additional appropriation of

Photograph by Bachrach Bros.

MARTIN WAGNER
Member Maryland Commission
Died December 28, 1903

$40,000 well along in the session, your Commission could give the Exposition management no assurance that Maryland would have any State building, and by reason of the undue delay we forfeited the right to our original site. As soon as the appropriation of 1904 was assured your Commission acted with the greatest possible expedition in having a new site, which proved to be a good one, assigned for our State building, which was next to the building of our neighboring State, West Virginia, and not far from the New York State Building. Plans had been prepared for the building in anticipation of the passage of the act making the additional appropriation, which was approved by the Governor on March 9, 1904, and the building, decorated, furnished and complete was dedicated on the eighth day of the following June.

The Louisiana Purchase Exposition was unique as compared to all other great World's Fairs in many particulars; but one distinctive and most happy characteristic in which it differed from its fore-runners was in the development of the social life of the Exposition. Few features of the Exposition contributed more to the pleasure of the visitors from our State than the Maryland Building, where everyone was welcome, and where everyone was sure to find friends. The Maryland Building was far more successful than your Commissioners anticipated; and the dignified and simple but none the less cordial hospitality at all times extended to Marylanders and their friends, as well as strangers from all over the world, won many friends from home and elsewhere. Mrs. Fisher lived in the Maryland Building throughout the Fair as the Commissions' official hostess. Mr. Albert Jones of Carroll County, assisted part of the time by Mr. G. Smith Norris, of Harford County, was in charge of the Maryland State Building, and was assidious in the performance of the difficult duties devolving upon him. His close acquaintance with all departments of the Exposition, the officials in charge, the City of St. Louis and his general experience and unfailing courtesy fitted him peculiarly to be the friend and adviser of all who sought his assistance. It is hard to comprehend how the building could have been dispensed with. It was ornamental and useful, adding materially to the charm of the landscape but no less to the memories of the visitors who always crowded its doors as if reluctant to leave its homelike shelter.

INTERIOR MARYLAND STATE BUILDING

CHAPTER IV.

The Maryland Building.

The Maryland State Building at the Louisiana Purchase Exposition occupied the site originally allotted to the State of Colorado between the West Virginia and Oklahoma Buildings in the midst of a group of State Buildings. The contract for the construction of the Maryland Building was let to the lowest bidder, the firm of Broderick & Wind, Engineers and Contractors of St. Louis, on the 23d day of March, 1904, and the building was completed and accepted by the Commission on the 8th day of the following June. The contract price paid the builders was $18,000 to which must be added the cost of furniture and decorations as well as a few extras not included in the original specifications.

Messrs. Ellicott and Emmart, of Baltimore, Architects, designed and superintended the construction of the Maryland Building. The work done by these gentlemen, who spared no pains or efforts, was most helpful to the Commission, and it is largely due to them that our building, which in character of construction as well as in beauty of architectural design, rivalled any building on the grounds, was successfully built in the record-breaking time of seventy-six days.

The building, which was almost an exact reproduction of the Maryland Building at the Charleston Exposition, may be described as a Casino erected in a natural park in a grove of oaks and fronting on one of the principal highways of the Fair grounds. It was carried out in the Roman composite order and on a monumental scale.

The length of the building, over all, was one hundred and forty feet including the semicircular end porches and its depth was about forty feet while the columns of the front, of which there were six, reached a height of twenty-five feet. The exterior was ornamented with bold and luxuriant detail. Immediately over the center was a well-modeled representation of the Maryland arms with supporting figures a little more

Photograph by Getz

FRANCIS E. WATERS
Member Maryland Commission

than life size, and combined with this was a flag staff upon which the Maryland flag was displayed.

The building was surmounted by a classic cornice and balustrade. The entrance loggia was fifty-five feet long and was decorated with a brilliant color scheme the effect of which was heightened by the snowy whiteness of the building itself. Passing through the loggia by one of three large doorways the Reception Hall was entered. This apartment had a length of fifty-five feet, a width of twenty-five and a height of twenty-eight feet. The building could accommodate about five hundred people, and more than 50,000 people visited it during the Fair.

The ceiling was vaulted and was flanked on both sides above the cornice by six lunettes each six feet in diameter. These, except the central one opposite the entrance, were decorated with gilt shields, palms, and flags gracefully grouped. The central one contained an allegorical picture painted for the purpose by Miss Dora L. Murdoch of Baltimore. It represented the genius of Maryland, a beautiful woman, receiving the increase of the earth from the hands of a youth on one side, and a maiden on the other. In the background was seen the water-front of Baltimore as it appeared before the great fire, with the harbor and shipping. The picture added very much to the distinction and finish of the room.

At the left was a room for the Commissioners and at the back a lunch room and pantry. Above, at this end of the building, there was a room for the Superintendent as well as rooms for the Janitor and his wife.

The outlook from the rear being very attractive it was deemed advisable to have a narrow gallery fifty feet long on this side of the building and this added much to the comfort of the guests.

The south end of the building was occupied, on the ground floor, by a Reading Room for magazines, newspapers, etc., and a long lounging room for men with toilet rooms attached. Both rooms connected with the south porch. Above them was a ladies' parlor, retiring room and toilet. The building was appropriately and handsomely furnished. The building was decorated by many interesting paintings and historic relics,

Photograph by Folk

WILLIAM A. MARBURG
Member Maryland Commission

loaned to the Commission by individuals, the State Government and the Maryland Historical Society, etc.

By the terms of the contract for the construction of the State building it was to revert to the contractors at the close of the Exposition, and your Commission was thereby saved the expense of removing it from the Exposition grounds.

At the close of the Exposition the furniture in the Maryland Building was sold and the borrowed decorations returned to the owners.

CHAPTER V.

Official Ceremonies.

Dedication of the Exposition.

The dedicatory ceremonies of the Louisiana Purchase Exposition took place in the Liberal Arts Building, World's Fair Grounds, on the 30th day of April, 1903. They were designed to commemorate the one hundredth anniversary of the signing of the treaty for the purchase by the United States from France of the Louisiana Territory by Livingston, Monroe, and Marbois; and also to dedicate formally the grounds and palaces of the Exposition, then nearing completion, though not to be opened until the year after.

The exercises were participated in by representatives from nearly all civilized nations, and in the presence of the President of the United States, the Joint Committee of Congress, the ambassadors and ministers of twenty-six foreign governments, and the governors and representatives of more than forty States and territories.

Maryland was represented on that great occasion by His Excellency, Governor John Walter Smith, attended by his military staff, comprising General Francis E. Waters, General Charles A. Chipley, General L. Victor Baughman, General John B. Schwatka, General Murray Vandiver, Colonel George M. Upshur, Colonel Arthur D. Foster, Colonel John P. Moore, Colonel Arthur P. Gorman, Jr., Colonel W. Laird Henry, Colonel Albert W. Sisk, Colonel Robert Taylor, Colonel John Waters, Colonel Israel Rosenfeld, Colonel Charles Goldsborough, and by your Commissioners and a number of officials and distinguished private citizens of the State who accompanied the Governor and your Commissioners in order to take part in the ceremonies.

The dedicatory address was made by President Theodore Roosevelt; the orator of the day was Ex-President Grover Cleveland; and the invocation was by His Eminence Cardinal Gibbons of Baltimore. Bishop E. R. Hendrix, of the Southern Methodist Church, offered prayer, and Bishop Henry C. Potter, of the Protestant Episcopal Diocese of New York, pronounced the benediction.

Our State was also represented at the ceremonies which extended through May first and second; the greeting to those taking part in the Exposition was delivered by Hon. David R. Francis, President of the Exposition, and the responses were by the French Ambassador, M. Jusserand, and the Spanish Minister, Señor Ojeda.

The Governor of Maryland and military staff, and your Commissioners were also asked to review the great civic parade on May 2 in which 30,000 persons took part from the St. Louis Club.

The Maryland party was warmly greeted and shown every courtesy by the members of the Maryland Society of Missouri.

DEDICATION OF THE MARYLAND STATE BUILDING.

The Maryland State Building was dedicated with appropriate ceremonies on the 8th of June, 1904, in the presence of the Governor of Missouri, A. M. Dockery; the President of the Exposition Company, David R. Francis; Mr. C. M. Reeves, Chief of the Department of Exploitation; and nearly five hundred persons, most of whom were Marylanders, and was formally turned over to the Exposition authorities. The occasion was one of the utmost enthusiasm and the Fair officials, many of whom were present, were unanimous in their verdict that no State structure on the grounds was dedicated more successfully than that of Maryland.

The dedicatory ceremonies were in charge of the following directors of the Maryland Society of Missouri: Murray Carleton, President; Frank J. McMaster, First Vice-President; William H. Thomson, Second Vice-President; T. Garrison Morfit, Secretary; Leonard Matthews, Treasurer; E. C. Simmons, R. J. Lackland, Frank Ridgely, D. M. Howser, C. S. Brookings, C. L. Hilleary, Dr. Y. H. Bond, William H. Lee, and John F. Lee, and were held at one o'clock p. m. in the Maryland State Building.

Photograph by Blessing and Fengé

MILITARY STAFF GOVERNOR SMITH

The building was lavishly decorated with flags and was fragrant with flowers. The black and gold colors of the State were shown on all sides. The occasion was graced by the presence of many foreign commissioners and commissioners from other States.

General L. Victor Baughman, Chairman of the Maryland Commission, presented the Building to the Exposition in the following words:

"As Chairman of the Maryland Commissioners it is my proud privilege to call this representative body of citizens together. Our meeting is for the purpose of accepting conditionally this beautiful structure from the hands of the builders and our architects.

"Some two years ago a body of representative citizens of St. Louis visited our State Capitol and before the Legislature of Maryland made known the plans then being formed to celebrate one of the most important events in the annals of American history. Impressed with the importance of so grand an enterprise a liberal appropriation was made and placed in the hands of the Commissioners appointed by John Walter Smith, Governor of our Commonwealth.

"Little did we dream, however, at that time of the magnitude and wonder of this Exposition. The men interested with the creation of this celebration, imbued with true American spirit, had determined to eclipse all other Expositions ever held, and consequently every State in the Union joined hands with the Louisiana Commissioners in making this Exposition the wonder and admiration of the civilized world.

"The Maryland Commissioners were obliged to again appear before the Legislature of their State for an additional appropriation. Maryland ever ready to take her part in all great events pertaining to the welfare of her people and of the Union, was prepared to grant the request, but at that time there swept over our Monumental City one of the most destructive conflagrations ever known in the annals of history. Where once stood superb banking and trust buildings, old and substantial stores, and massive warehouses, all were in two days a mass of smoldering ruins. Merchants and business men stood amid their ruins and gazed in awe at the frightful scene. Tears and lamentations ill become the men who boast of their long line of colonial and revolutionary sires, and

Photograph by Getz

FRANKLIN P. CATOR
Member Maryland Commission

while the world and sister cities were generously offering us their aid, we determined as Marylanders to stand together and bear alone the terrible blow like the heroes of old. Our Legislature and the people of our State determined to show to the world that we would build up our ruined places and again seek and secure our share of trade by fair and honest competition. We turned our backs upon the smoldering ruins of buildings, forgot that over one hundred and eight acres of magnificent structures had fallen and that in two days we had suffered a loss of millions and millions and millions. So amid splendid palaces erected by the States of the Union upon these beautiful grounds we to-day turn Maryland's home over to the Exposition.

"As a matter of course we should love to refer to Maryland's course at the time of the acquisition of the vast Territory embraced in the Louisiana Purchase. We feel we are rich indeed in the part taken by our people in all the events connected with the early history of the young Republic. We have been taught to honor and revere the Constitution of our country and fully realize the difficulties confronting the fathers of the Republic when the soldier and statesman of France urged the purchase of the vast territory lying beyond the western banks of the great father of rivers.

"Jefferson, who believed in a strict construction of the Constitution and in living up to the very letter of the law, saw the difficulty in acquiring foreign territory or in incorporating foreign nations in our Union. The same sterling provisions confront us to-day. Again Jefferson, in discussing the treaty, stated: 'I had rather ask an enlargement of power from the nation were it found necessary than to assume it by a construction which would make our power boundless. Our peculiarity is in the possession of a written constitution, let us not make it blank paper by construction.'

"The treaty, however, was ratified, but the constitutional difficulties were still unsettled. The acquisition doubled the area of the country and secured control of all the great river systems of North America.

"The Governor of our State sends his greetings to the President and Commissioners of the Exposition, and through his Adjutant-General

Photograph by Perkins

ORLANDO HARRISON
Member Maryland Commission

begs to wish every success and prosperity to this great undertaking. In the absence of our Chief Executive, as Chairman of the Maryland Commissioners, I now turn this building over to the hands of the Commissioners of the Louisiana Purchase Exposition."

Ex-Governor David R. Francis, President of the Exposition, responded. It is to be regretted that because he spoke extemporaneously his speech cannot be reproduced in full. He said in part:

"It not only affords me pleasure to participate in this affair, but I feel highly honored by the privilege. There are always ties that bind the people of Missouri to those of Maryland."

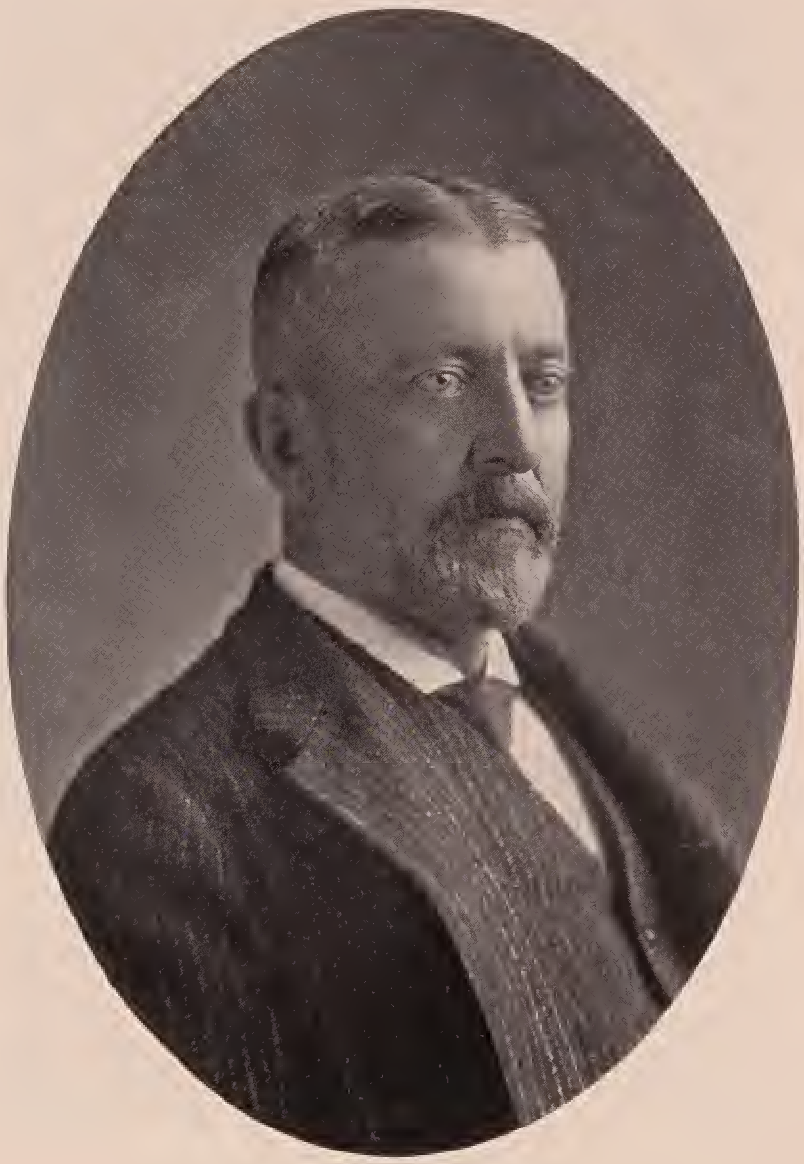
He spoke of the fact that on the list of the directors of the Exposition were several sons of Maryland who are now making their homes in St. Louis. The gratification of the Exposition authorities at the appropriation made by Maryland for the Fair, notwithstanding the critical situation produced by the big fire, was expressed. He declared that the public spirit of the people of Baltimore in not calling on Federal Government for aid at the time of the fire enabled the Exposition officials to secure the aid from the Government which they were at that time asking.

Governor Francis reviewed the work of the Exposition and spoke of its vastness and its effect. In concluding he said:

"On behalf of the Exposition managers I accept this structure and I now deliver it to the Maryland Commission, to be used as a home for the citizens of that State and their friends during the time of the Exposition."

Mr. Murray Carleton, President of the Maryland Society of Missouri, then spoke as follows:

"It gives me much pleasure in the name and on behalf of the Maryland Society of Missouri to extend cordial greetings and heartfelt welcome on this delightful occasion, which marks the dedication or setting apart of this beautiful building for the use of Exposition purposes. While years have intervened since many of us left our native State, time has not effaced the love we cherish for the home of other days, for the friendships of our youth, nor desire or interest abated to see our native



Photograph by Perkins

WILLIAM H. GRAFFLIN
Member Maryland Commission

State, now as ever, nobly making her contribution to one of the crowning events of a hundred years of national history.

"The participation of Maryland in this, the greatest of national and international expositions, is a tribute to the patriotism, courage, and enterprise of the citizens of a Commonwealth whose annals are replete with events that have contributed largely to our national greatness. All the more is this true when we consider the great calamity—the disastrous fire—which almost destroyed the metropolis of the State, yet out of which issued the success and achievement which we to-day are so delighted to acknowledge.

"Therefore, with becoming pride as former Marylanders, we rejoice that our native State is here represented, and has a part in this universal Exposition, which we believe has been divinely ordained and commissioned to light afresh a beacon fire of truth, education, and civilization that shall spread from shore to shore, from continent to continent, until its flames shall illumine all nations of the earth, inspiring all peoples with holy zeal, with sacred endeavor to the earlier consummation of the universal peace, and the establishing of a friendly rivalry among the nations of the earth in the higher and yet higher development of our already marvelous civilization.

"Then welcome, thrice welcome, ye sons and daughters of our native State. Kindly express to those at home the good will, friendship, and affection we shall ever foster, preserve, and perpetuate through our children for Maryland, my Maryland."

The exercises were closed by a brief address from Governor Dockery of Missouri who delighted the crowd with his tribute to Maryland and Maryland men, and the warm welcome which he extended to all those present. The exercises closed with the singing of "Maryland, My Maryland."

After the building had been formally declared open the whole company was entertained at an elaborate luncheon given by the members of the Maryland Society of Missouri.

On the next afternoon (June 9), the first public reception given by the Maryland Commission in the new State Building was held from 4

THOMAS H. ROBINSON
Member Maryland Commission

to 6 o'clock, and was the occasion for the presence of a large number of distinguished persons.

The members of the Maryland Society of Missouri with their wives, were present, and many visitors from other States and foreign countries attended.

This occasion marked the beginning of the popularity which it is gratifying to know distinguished the Maryland Building throughout the Fair. Among others present were: General and Mrs. Francis E. Waters, General and Mrs. Clinton L. Riggs, Senator and Mrs. John S. Biddison, Col. and Mrs. Arthur D. Foster, Mrs. John Gill, Mrs. C. D. Lee, Senator and Mrs. David M. Devilbiss, Hon. E. E. Goslin, Hon. James E. Godwin, Mr. J. T. Hayward, Mr. Joseph Y. Brattan, Mr. Frank R. Kent, Mr. Van Winkle, Mr. Augustus F. Trappe, Mr. A. E. Sullivan, Mr. Charles A. Webb, Miss Webb, Miss Elizabeth Webb, Mr. and Mrs. Franklin P. Cator, Mr. Orlando Harrison, Mr. Hale Harrison, and Mr. Jacob M. Pearce.

MARYLAND DAY, SEPTEMBER 12, 1904.

The most memorable and impressive, as well as the largest occasion of a formal nature in which our State took the leading part at the Louisiana Purchase Exposition was the Maryland Day Celebration on September 12, 1904, the anniversary of the battle of North Point.

Preparations were made for the celebration by your Commissioners months in advance, and every detail was arranged with painstaking care. All the State officials, the leaders of all the prominent business organizations, those prominent in advancing the agricultural interests of the State, many citizens prominent in the professions, in educational work, in literature, art, and charitable works in our State were invited specially to participate in the Maryland Day exercises. All the higher officials connected with the Exposition, the Commissioners from other States and countries, the members of the Maryland Society of Missouri, and numbers of others were also specially asked to be present. The result was a collection of people, assembled at Maryland Day ceremonies, which in number, culture, and reputation was not surpassed on any similar occasion.

JACOB M. PEARCE
Member Maryland Commission

On the morning of September 12, His Excellency, Governor Warfield rode from his quarters at the Buckingham Club, to the Maryland Building, accompanied by Secretary of State Oswald Tilghman, and the following members of his staff in full-dress uniform: Adjutant-General Clinton L. Riggs, General Van Lear Black, General Frank H. Hambleton, General John M. T. Finney, General N. Winslow Williams, Colonel H. Carroll Brown, Colonel E. L. Woodside, Colonel Richard S. Hill, Colonel J. Charles Macgill, Colonel Henry Holliday, Jr., Colonel Joseph L. Wickes, Colonel E. Austin Baughman, Colonel W. Hopper Gibson, Colonel John L. G. Lee, and Colonel M. Gillett Gill.

The Governor and his staff were escorted by Messrs. Murray Carleton, T. Garrison Morfit, Leonard Matthews, William H. Thomson, Dr. Y. H. Bond, C. L. Hilleary, John F. Lee, and Francis J. McMaster of the Maryland Society of Missouri.

At the parade entrance to the grounds the cavalcade was met by an escort of a body of United States Marines, with a band; the Philippine constabulary, with a band; the Jefferson Guard and the Philippine scouts with a band.

Governor Warfield was met at the Maryland Building by the Maryland Commissioners, and the party was joined by President Francis and Governor Blanchard and staff of Louisiana, and the military parade was reviewed from the front of the Maryland Building.

After the military parade which was followed by lunch served at the New York Building, the Governor and staff, accompanied by the Commissioners and their guests on the occasion assembled at Festival Hall for the ceremonies to take place there at 2 p. m., of which the following was the program:

PROGRAM, MARYLAND DAY EXERCISES.

FESTIVAL HALL, SEPTEMBER TWELFTH, 1904.

2 P. M.

INVOCATION..*Rev. J. R. Winchester.*

MUSIC, MARCH, TAR AND TARTAR..*Itzel.*

INTRODUCTION....................................*Gen. L. Victor Baughman,*
Chairman of the Maryland Commission.

MUSIC, MARYLAND MY MARYLAND..

ADDRESS..................................*His Excellency, Edwin Warfield,*
Governor of Maryland.

RECITATION, THE STAR-SPANGLED BANNER....................*Miss Edith Ford,*
Of Baltimore.

MUSIC, THE STAR-SPANGLED BANNER..

ADDRESS..*Hon. David R. Francis,*
President Louisiana Purchase Exposition.

MUSIC, DIXIE..

ADDRESS..*Hon. Rolla Wells,*
Mayor of St. Louis.

MUSIC, HAIL COLUMBIA..

ADDRESS...*General Joseph L. Brent,*
Of the Society of Colonial Wars.

It was at Festival Hall, where a great concourse of people congregated to witness the official exercises, that the climax of this most notable occasion was reached.

General Baughman, who presided, introduced Rev. J. R. Winchester of the Advent Protestant Episcopal Church, who made the invocation. Following this prayer General Baughman made an address.

The next address was by His Excellency, Governor Warfield. The Governor in closing his speech outlined briefly the history of Francis Scott Key and of Defenders' Day and prepared the audience for the recitation which followed of "The Star-Spangled Banner" by Miss Edith Ford of Baltimore. Miss Ford's recitation aroused unbounded enthusiasm.

President David R. Francis in his address paid a high tribute to our State, and the courage and enterprise of our people in persisting in carrying out the plans for a large exhibit and State Building after the paralyzing disaster suffered by us in the Baltimore fire.

Hon. Rolla Wells, Mayor of St. Louis, made a short but most appropriate address. Mayor Wells' presence was a noteworthy tribute since it was the only State celebration he took part in except the Missouri Day exercises.

The closing speaker was General Joseph L. Brent, of Baltimore, who delivered an able and scholarly address.

The address of His Excellency, Hon. Edwin Warfield, Governor of Maryland, was as follows:

"Mr. President, Ladies and Gentlemen:

"The three greatest epochs in American history have been commemorated by expositions. In 1876, the end of the first century of our independence was celebrated at Philadelphia in a manner that profoundly impressed our people and demonstrated that the United States possessed the spirit and the resources that were fast making her the greatest Government on the globe.

"In 1892, following the suggestion first made by the Baltimore *Sun*, the four hundredth anniversary of the discovery of the Western Hemisphere by Columbus was signalized by the World's Fair at Chicago. That Fair brought the whole world together in a grand display of its progress to commemorate that historic event. The growth of the North American Continent during those four centuries was exhibited there in a marvelous and instructive way.

GREATEST FAIR OF ALL.

"This Louisiana Purchase Exposition, the greatest of them all, emphasizes what has been accomplished during the hundred years that have elapsed since the acquisition of this vast Western domain by Thomas Jefferson in 1803.

"You, Mr. President Francis, and your associates are entitled to the applause and gratitude of our people for this wonderful Exposition of the magic growth and material development of our country, and especially of what the Louisiana territory has added in wealth to the United States.

"Your conception and execution of the plans for this Fair have resulted in a consummation unequaled in the annals of such enterprises. It is acknowledged to be the best exhibition of the world's development that has ever been assembled. All honor and glory to you, sir, and your associates!

Photograph by Murillo

MRS. MARIE ANTOINETTE SCHLEY FISHER

Member of Maryland Commission; Official Hostess Maryland State Building; President Hostess Association, Louisiana Purchase Exposition

MARYLAND'S TRIBUTE.

"Maryland, one of the States which favored the Treaty with France ceding Louisiana, has commanded me to lay her tribute at your feet and join with you to-day in praise of the statesmen whose wisdom and prompt action secured this splendid domain for our common country—Jefferson, Monroe, and Livingston.

"I am pleased to note that our Commissioners, headed by General Baughman, have co-operated with you in your work, and that our State is so creditably represented here under their direction.

"It is not my purpose to dwell upon the advantages to the people of such Expositions. The lessons taught by those of the past have satisfied us that the results flowing from such exhibtions of our material growth, and of our wealth and resources, are of untold benefit.

"On your opening day I sent you greetings from our people and promised that in due course of time Maryland would be with you to add her voice in praise of the statesmanship which gave us this Western territory, that has added so much to our national greatness and glory. For that purpose, we, her sons and daughters, are here to-day.

A DAY OF DAYS TO MARYLAND.

"We have come on this 12th of September, because it is one of the proudest and most sacred days in Maryland annals. It is the anniversary of the battle of North Point, the battle that turned the tide against the triumphant British Army, saved Baltimore from destruction, and virtually ended the War of 1812. It is known and celebrated by us as 'Old Defenders' Day,' and has for 90 years been annually observed in honor of the valor of our citizen soldiers.

"The British Army, under command of General Ross, having captured and sacked Washington city and laid the Capitol in ashes, sailed up the Chesapeake Bay with their combined military and naval forces for the purpose of destroying Baltimore.

ROSS KILLED; BRITISH REPULSED.

"Their general, Ross, was killed by sharpshooters, and our citizen soldiers met the British and repulsed and defeated them.

Photograph by Strauss

MURRAY CARLETON
President of the Maryland Society of Missouri

" Following up the attack, the British vessels, on the next day, made an attempt to take the city of Baltimore by bombardment from the ships. All night long there was fierce and constant cannonading, to which the defenders in Fort McHenry and from other temporary forts along the waterside, replied with spirit.

WHERE KEY COMPOSED NATIONAL ANTHEM.

" It was during this bombardment that Francis Scott Key, a son of Maryland, who was detained on the flagship of Admiral Cochrane, where he had gone under a flag of truce to procure the release of a friend, composed 'The Star-Spangled Banner,' the national anthem of our country.

" All during the dark hours of that night he waited and watched with anxiety the outcome of the battle. At one time his heart sank in him, as it seemed that Fort McHenry had been silenced.

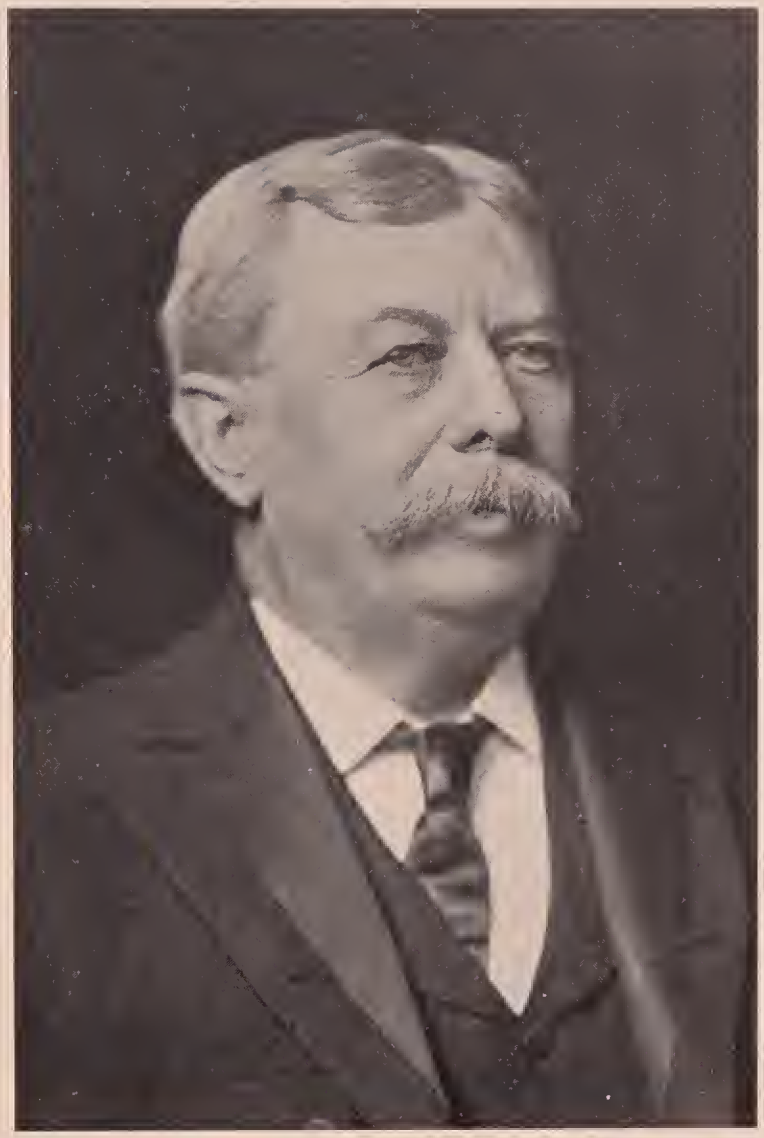
" We can appreciate his anxiety because he realized that, if such were the case, the fate of Baltimore would be the fate of the Nation's Capital. With eagerness he watched the dawn of day, that he might see whether the flag was still flying. It was during these trying moments that he wrote the immortal verses which have been so touchingly declaimed here to-day by one of our fair and gifted daughters.

SUCCESS OF THE SONG IMMEDIATE.

" The lines were written in pencil on the back of an envelope whilst leaning on the top of a barrel on the deck of the British ship. He carried them with him to the city when he was released, had them adapted to a tune already existing, and they were sung to the public for the first time in the city of Baltimore. The success of this song, written under such stress of patriotism, was great. 'The Star-Spangled Banner' has taken its place as our beloved national anthem.

" A noted Maryland orator, referring to this historical incident, said:

" 'The Stars and Stripes themselves had streamed at the front of two wars before the kindling genius of a Maryland man, exercised in



Photograph by Mesny

HENRY J. McGRATH
Member Maryland Commission

the white heat of battle, translated the dumb symbol of national sentiment into a living voice, and made it the sublime and harmonious interpreter of a nation's progress and power.'

MARYLAND'S SERVICE TO THE NATION.

"The people of the United States owe to the State of Maryland a great debt for the part she played in establishing our independence and the formation of the Union.

"It was her bold, determined, and unswerving stand against the ratification of the Articles of Confederation that resulted in the cession to the United States of what was then known as the Northwest territory.

"Many of the original colonies which had received charters from the Crown believed that there were no set boundaries at the west, and that their grants extended to the 'Western waters.' New York, Massachusetts, Connecticut, and Virginia were foremost in making such claims. Virginia, whose charter antedated all others, had the best title to the lands in dispute. Hence, she was the most tenacious in her claims.

"The other States naturally felt that, as these larger States grew and waxed powerful, they might tyrannize over their smaller neighbors.

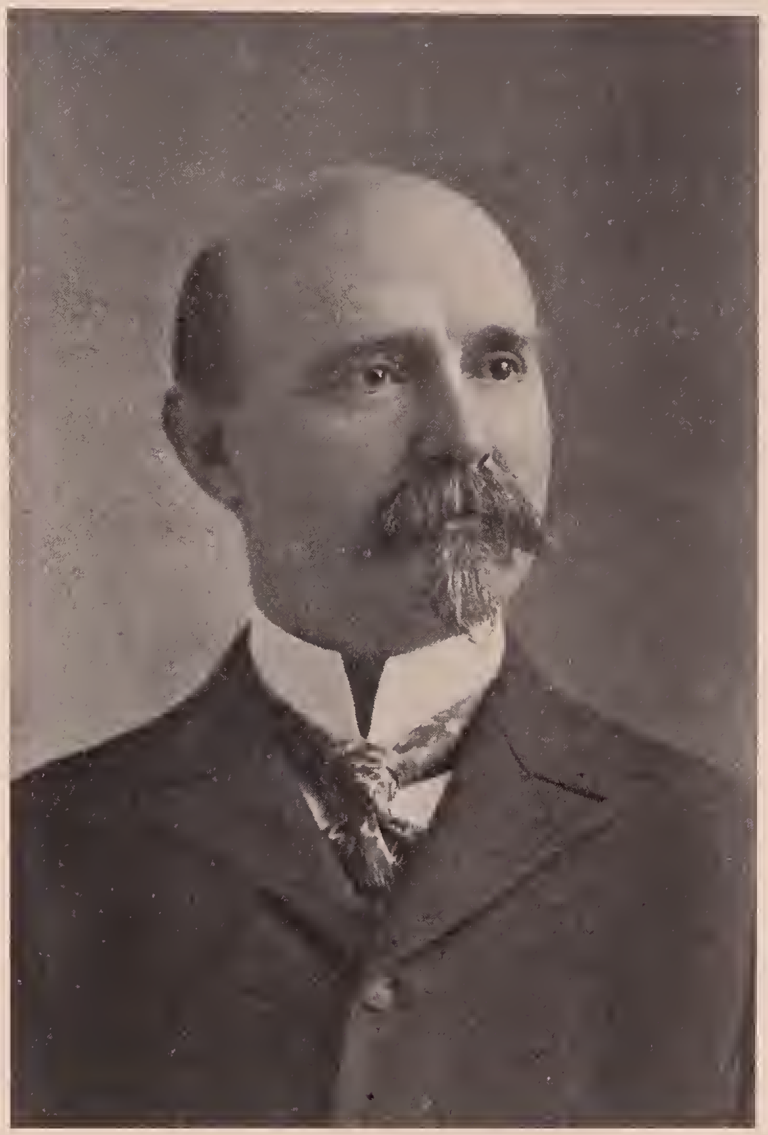
THIS STATE AROSE TO THE OCCASION.

"Of all these protesting States, it was Maryland alone that rose to the occasion and suggested an idea which at first seemed startling, but which became a fixed fact, from which mighty and unforeseen consequences afterward flowed.

"The Articles of Confederation were about to be presented to the respective States for ratification, when the question naturally arose as to how the conflicting claims to these Western lands should be settled.

"A Marylander, Daniel Carroll, offered in Congress a resolution that

"'The United States, in Congress assembled, should have the sole and exclusive right and power to ascertain and fix the western boundary of such States as claimed to the Mississippi, and lay out the land so ascertained into separate and independent States from time to time as the number and circumstances of the people may require.'



Photograph by Strauss

FRANCIS J. McMASTER
Vice-President of the Maryland Society of Missouri

"To carry out this motion it was necessary for the States claiming this Western territory to surrender their claims into the hands of the United States, and thus create a domain which should be owned by the Confederation in common.

BOLD STEP, BUT SUCCESSFUL.

"This was a bold step taken by Maryland, and was considered to smack somewhat of centralization of power. Maryland was the only State that voted for it. She stood firm, pursued her purpose resolutely, and was rewarded with complete success.

"New York, Virginia, Connecticut, and Massachusetts finally ceded their title to these lands, and Maryland ratified the Confederation, having first secured as the common property of the United States all of the immense territory which has since been parceled out and established by Congress into the free and fertile States of Ohio, Indiana, Illinois, Michigan, and Wisconsin.

"Thus the Confederation was perfected, the Union preserved, and this great territory was saved for the benefit of the whole united people.

LAID CORNER-STONE OF UNION.

"Maryland, by taking the stand she did and leading the way in this fight, laid the corner-stone of our Federal Union.

"The rising tide of immigration poured into this Western country, creating a sturdy and determined citizenship there, so that when Spain claimed the exclusive right to navigate the Mississippi River and decided to abrogate the privilege that had been enjoyed by these settlers to deposit their products at the mouth of the Mississippi River for exportation, the cry of hot protest came from these fearless pioneers of the West, notifying the politicians of the New World that these freemen of the frontiers of the nation would not tolerate the abridgment of their rights and would insist upon the free navigation of the Mississippi River and their right to send their products through it to the ocean.

Photograph by Strauss

WILLIAM H. THOMSON
2d Vice-President of the Maryland Society of Missouri

WORK OF JEFFERSON AND MONROE.

"It was this vigorous protest of these new sons of the West, demanding prompt action by the Administration at Washington, that aroused President Jefferson and caused him to take steps looking to the acquisition of New Orleans and securing from France the right of deposit and free, uninterrupted navigation of the Mississippi River.

"He at once sent James Monroe to Paris to negotiate—not the purchase of the entire Louisiana Territory, but simply to acquire New Orleans and the Floridas east of the Mississippi River; and, failing in that, then to secure the right to our citizens to own property in New Orleans and to deposit their products for export.

"When Mr. Monroe reached Paris he found that our resident Minister, Mr. Livingston, had been in negotiation with the French Government for the purchase of New Orleans and the Floridas. He also found that Napoleon, then the First Consul, had declared his purpose of selling the whole of Louisiana to the United States, because of the fear that England would seize that territory as her first act of war. In an interview with Marbois, one of his Ministers, upon the subject, Napoleon said:

"'Irresolution and deliberation are no longer in season. I renounce Louisiana. It is not only New Orleans that I cede—it is the whole colony, without reserve. I know the price of what I abandon. I have proved the importance I attach to this province, since my first diplomatic act with Spain had the object of recovering it. I renounce it with the greatest regret; to attempt obstinately to retain it would be folly. I direct you to negotiate the affair, and have an interview this very day with Mr. Livingston.'

"I will not weary you with the details of the negotiations resulting in the purchase of the whole of Louisiana. The price paid was $15,000,000, and France ceded this immense territory to the United States on April 30, 1803.

Photograph by Strauss

T. GARRISON MORFIT
Secretary of the Maryland Society of Missouri

STATES CARVED OUT OF WILDERNESS.

"What a progressive, prosperous group of States and Territories has been carved out of this land—Arkansas, Iowa, Missouri, Nebraska, North and South Dakota, parts of Kansas, Colorado, Montana, Minnesota, Wyoming, and Louisiana, all of the Indian Territory, and part of Oklahoma! Its area is more than seven times that of Great Britain and Ireland. It is larger than Great Britain, Germany, France, Spain, Portugal, and Italy combined, and is only one-fourth less than the area of the thirteen original States.

"Two of these States, Colorado and Montana, produced in one year $89,938,708.95 in gold, silver, copper, and lead—over five times the purchase price paid by the United States.

"The annual agricultural products reach a total of billions in this territory, and its present population is over 13,500,000.

THE STORY OF MARYLAND.

"We Marylanders are proud of the history of our State, and venerate the deeds of our forefathers. Therefore, I ask your indulgence whilst I briefly tell you the story of Maryland. She stands as the seventh in the original galaxy of thirteen States, because she was the seventh to adopt the Constitution forming the permanent Union. The very foundation of the colony of Maryland was of national importance, because the principle of religious toleration was introduced by the founder. From the time of the landing at St. Mary's until to-day liberty of conscience has been the fundamental right of every person in Maryland.

TRUE HISTORY OF ACT OF TOLERATION.

"Much has been written upon the subject of the Act of Toleration of 1649. The true history may be briefly stated. Cecilius Calvert, being vested with extraordinary power over a great territory, determined to found there a free English State, where all the rights and liberties of every English freeman would be protected. To do this he divested himself and his heirs of the princely prerogatives granted to him by

Photograph by Genelli

LEONARD MATTHEWS
Treasurer of the Maryland Society of Missouri

his charter. He caused to be drafted at home, and then adopted by the freemen of Maryland, codes of laws which transferred English institutions to Maryland. By orders, proclamations, and conditions of plantation he strengthened and fortified these institutions thus transplanted. Believing that Magna Charta and the right of petition guaranteed every Englishman the right to liberty of person and security of property, he was wise enough to see and brave enough to declare that these rights were worthless without liberty of conscience.

"He, therefore, adopted and declared that to be the principle on which the foundations of Maryland should be laid. From the first he intended to secure all those rights, privileges, and franchises, not alone to Roman Catholics, nor yet alone to Englishmen, but to all Christian people of all the nations of the world.

"In doing this he was supported by the whole social influence of the Roman Catholics of England, and by the power of the Society of Jesus.

SAFETY AND SHELTER FOR ALL.

"Under this institution the Puritans settled at Providence, the Quakers at West River, and the Presbyterians on the Patuxent. It gave shelter to the Huguenots after the massacre of St. Bartholomew, and to Roman Catholics from the murders and burnings of San Domingo.

"Notwithstanding its repeated external overthrow by force or faction, it has always been imbedded in the life of the people. In the wars, insurrections, revolutions, rebellions, and civil broils which swept the province in its earlier days, neither life, liberty, nor property has ever been sacrificed in the fury of religious fanaticism. Blood has been shed in the struggles of factions, but no man has ever been put to death on account of his religion in Maryland.

STRUGGLED FOR FREEMEN'S RIGHTS.

"The growth of popular government was early manifested in Colonial Maryland. In the very first Assembly, in 1635, every freeman was

GROUP AT DEDICATORY EXERCISES, MARYLAND STATE BUILDING entitled to a seat and voice in the proceedings. The second Assembly was held in 1637, and the freemen rejected the code of laws offered by Lord Baltimore, although liberal and just, claiming the right to originate legislation for themselves. Thus began the fight in Maryland for the rights of freemen.

"In 1739, the Assembly successfully opposed taxes being imposed without its consent, and this fight went on until 1765, when the attempt to place taxes by Parliament and the tea tax of 1767 so aroused the people that the protest was universal throughout the colony.

"Meetings were held all over the State to protest against the closing of the port of Boston, and provisions were sent to aid the almost starving people of that city, thus showing the earnest sympathy of the people of Maryland in their fight for the great principle of 'No taxation without representation.'

BURNING OF THE PEGGY STEWART.

"In all of the movements that led up to the Declaration of Independence and the Revolutionary War, Maryland stood in the forefront. The first overt act of her people against the authority of the King of England was on October 19, 1774, when her fearless patriots compelled Anthony Stewart to burn his brig, the Peggy Stewart, with her cargo of tea, in the harbor of Annapolis. This was done in broad daylight, by men undisguised, whose motto was 'Liberty, or death in the pursuit of it.'

"Thomas Johnson, of Maryland, nominated George Washington in the Continental Congress to be Commander-in-Chief of the American Army.

"The Maryland Riflemen, under Michael Cresap, were the first organized troops to respond to the call of liberty. They fought side by side with the Puritans of Massachusetts at Concord and Lexington.

MARYLAND'S "FOUR HUNDRED."

"It was Maryland's 'Four Hundred,' under the intrepid Gist, who, after six successive bayonet charges, saved Washington's army at Long

Photograph by Blessing and Fengé

HIS EXCELLENCY EDWIN WARFIELD
Governor of Maryland, 1904-1908

Island in August, 1776. The greatest crisis in that battle was the superb action of these immortal Marylanders. They held the British army of 4000 in check until the Americans moved across to the Jersey shore. Two hundred and sixty-seven of their number were killed or wounded.

"Their bravery and heroism caused General Washington to exclaim, 'Great God! what brave men I must this day lose.'

COVERED WASHINGTON'S RETREAT.

"The 'Maryland Line,' under command of Colonel Smallwood, composed Washington's rear guard in his masterly retreat through New Jersey.

"Maryland soldiers participated in every hard-fought battle of the Revolution, from Long Island to Yorktown, and were especially distinguished for bravery at Camden, Eutaw Springs, Guilford Courthouse, Hobkirk's Hill, and Cowpens. They were the 'Old Guard' of the Continental forces, 'the bayonets of the Revolution.'

COLONEL TILGHMAN'S FAMOUS RIDE.

"It was a son of Maryland, Col. Tench Tilghman, Washington's aide, who rode from Yorktown to Philadelphia, carrying the news of Cornwallis' surrender to the Continental Congress. He crossed the Chesapeake Bay to the Eastern Shore of Maryland in an open boat, where, procuring a horse, he started on his way, riding in the dim watches of the night. When his horse gave out he would ride up to a house and call out, 'A horse for the Congress, Cornwallis is taken.' There was a flash of light, a patter of glad feet, a welcome, and a godspeed. This was repeated time and again, until finally, thundering into Philadelphia at midnight, Independence bell was rung, Congress convened, and the watchman on his round proclaimed, 'Twelve o'clock; all's well, and Cornwallis is taken.'

"Maryland has taken a foremost place in our wars since the Revolution, and in every movement for the advancement of liberty, the welfare

GOVERNOR WARFIELD AND MILITARY STAFF AT THE EXPOSITION of the people, and the maintenance of the peace, prestige, and dignity of our Government.

HER CONTRIBUTION TO THE WAR OF 1812.

"She contributed more money and men for the War of 1812 than any other State. The annals of that war show that of the 240 naval officers who served on our ships, Maryland furnished 46, nearly one-fifth, and more than any other State; all of the New England States together sending only 42, and New York but 17. And in the number of privateers sent out to prey upon British commerce, Baltimore headed the list of cities.

"Her quota of volunteers for the Mexican War was promptly recruited. They were a brave band of soldiers, and won glory for their State. When General Taylor called for 'a little more grape, Captain Bragg,' it was Ringgold's Flying Artillery (from Maryland) that furnished the grape.

SENTIMENT DIVIDED IN 1861.

"In 1860, Maryland's electoral vote was cast for Bell and Everett, showing that a majority of her people were for the Constitution and the Union. Although a majority of her most substantial citizens sympathized with the cause of the South, she refused to secede from the Union. Her sons were divided in the contest. Those who wore the gray believed that the South was right, and, so believing, fought bravely, and endured sufferings and privations for the faith that was in them and the cause they espoused. So with those who volunteered to sustain the Union. Maryland honors the valor of all of her sons, those who wore the gray as well as those who wore the blue.

"In evidence of this spirit she has erected a monument upon the battlefield of Antietam to commemorate their devotion to duty. On the tablets are inscribed the names of the commands, Union and Confederate, and the battles in which they participated.

"This monument was presented to the National Cemetery Commission by the State of Maryland in the presence of old soldiers of both

Photograph by Strauss

HON. ROLLA WELLS
Mayor of St. Louis

armies, and was accepted by our martyred President, William McKinley, who did more than any other public man to obliterate the animosities of the war and reunite our people.

DID NOT HANG BACK IN 1898.

"Maryland's quota of volunteers for the Spanish War was quickly furnished. Her National Guard responded enthusiastically, each regiment clamoring to be sent to the front.

"Maryland took the initiative in many important matters of legislation. She passed the first law to naturalize a foreign-born citizen. She was the first State to recognize by law the possibility of steam navigation. She did this by granting to James Rumsey the exclusive right of steam navigation in the waters of the State. She was the first State, after Virginia, to embody in her form of government the famous Bill of Rights formulated by George Mason.

HISTORICAL EVENTS UPON HER SOIL.

"Many interesting historical events have taken place upon her soil. It was in the Senate Chamber in the old Capitol, now standing, at Annapolis, that Washington resigned his commission as commander-in-chief of the army and returned it to Congress and retired to private life—the sublimest act of his sublime life.

"It was in that hallowed chamber that the treaty of peace with England, which ended the war, was ratified by Congress.

"It was in that same historic chamber that the initial convention was held to promote the organization of a more permanent government. It suggested the calling of a convention to formulate a Constitution and found the Union.

CRADLE OF PRESBYTERIAN CHURCH IN AMERICA.

"Maryland was the cradle of the Presbyterian Church in America. The first regularly constituted church of that denomination in the United States was erected at Rehoboth, Somerset County, now Wicomico

County, with Rev. Francis Makemie as its first minister. Maryland was the only colony where the Presbyterians could get toleration.

"It was in Maryland that the first bishop of the Episcopal Church consecrated in America resided—Right Rev. Thomas John Claggett, Bishop of the Diocese of Maryland, who performed an important part in laying the foundations of this great and historic church.

"It was in Maryland that the Methodist Episcopal Church of America was established, and the first house of worship built by that now powerful Christian denomination that has done so much for the upbuilding of both civilization and religion in this, as well as in other countries.

OLDEST ROMAN CATHOLIC DIOCESE.

"In Maryland is the oldest Roman Catholic diocese in the United States—the Archdiocese of Baltimore.

"The first Archbishop of that Church in this country was a Marylander, and it is fitting that the name of Archbishop Carroll should be linked in State pride with that of his kinsman, Charles Carroll of Carrollton, the signer of the Declaration of Independence.

"Maryland to-day is the head of the Roman Catholic hierarchy. Representing that Church we have in Baltimore its only Cardinal in the United States—Cardinal Gibbons—that man of simple and pure life, true Americanism, and high patriotism.

"Thus it will be seen that upon Maryland's soil was first established in the United States these four great Christian churches, that have been such potential forces in shaping the destiny and greatness of our nation.

"Not only has Maryland been the scene of historical events, but many of the important industrial, inventive, and scientific conceptions have been born within her borders.

FIRST STEAMBOAT FLOATED IN HER WATERS.

"It was in Maryland waters that the first steamboat was floated. It was invented by a Marylander, James Rumsey, 25 years before Fulton launched the Claremont. General Washington, who witnessed the trial on the Potomac, gave a certificate of the success of the experiment.

FIRST RAILROAD IN AMERICA.

"It was in Maryland that the first steam railroad in America was built, and the first electric railway in the world was operated. It was in Maryland that the first iron plates for shipbuilding were made. It was in Maryland that the first telegraph line in the world was constructed, and the first water company and the first gas company were organized. It was a Marylander, Obed Hussey, who invented the first sickle knife for reapers, and the first perfect and successful self-raking reaper was invented by Owen Dorsey, of Howard County, Maryland.

"The heraldic device of the Great Seal of Maryland discloses the fact that the supporters of the shield are a farmer and a fisherman. In the days of the province these two avocations were the only ones, and to-day they form the most important factors in the prosperity of the State.

AS AN AGRICULTURAL STATE.

"The agricultural products of the State amount to $43,823,419 annually. No more favored land for agricultural purposes can be found in the United States. While corn, wheat, and tobacco are the staples, yet every product of the temperate zone can be produced within her borders in the greatest abundance.

"Frederick County, the home of General Baughman, ranks as the third agricultural county in productiveness in the United States.

"Of Maryland's total area of 12,210 square miles, 2350 are covered by the waters of the Chesapeake Bay and its tributaries, which teem with terrapin, oysters, crabs, and fish in almost endless variety, while to the swamps and the marshes annually come thousands of ducks, geese, and other wild fowl. The value of the annual yield from the products of these waters is over $10,000,000.

NOT BACKWARD IN MANUFACTURES.

"Maryland is also taking her place in the front rank of manufacturing States. Her output of manufactured goods last year amounted to $242,752,990. By reason of her proximity to the stores of raw material, to the great coal fields, and her splendid water power, with unequaled water courses and great railroad connections, there is every inducement for the establishment of manufactories.

"The mineral resources of Maryland are extensive, and but partly developed. Iron ore is abundant and of good quality. Limestone and marble of good quality, and granite unequaled, are profusely distributed throughout the State. Her coal mines are practically inexhaustible, and yield more than $5,000,000 annually. Her deposits of clay and kaolin furnish material for brick and pottery.

HEALTHY CLIMATE, HOSPITABLE PEOPLE.

"Her climate is salubrious and healthy. Her hills and dales are pleasing and attractive to the eye. Her people are hospitable and cultured. Her public schools rank with those of any State in the Union. Her taxation—for State, county, and municipal purposes—is moderate. Her churches are numerous, and her people are moral and law-abiding.

"In fact, Maryland can boast of a citizenship, of a culture, of everything that promotes happiness and contentment. In the words of her distinguished poet, Randall, the author of 'Maryland, My Maryland,' 'There is faith in her stream; there is strength in her hills; there is life in the old land yet.'

BALTIMORE A CITY OF FAIR WOMEN.

"I cannot close without referring to our metropolis, Baltimore, our beautiful city, famed for her fair daughters, her monuments, her beautiful parks, her churches, her colleges of medicine and law, her great Johns Hopkins University, which has in a quarter of a century won a position in the front rank of the universities of the world, of her hospitals—unsurpassed in their equipment for ministering to suffering humanity, of her libraries, her old Historical Society, filled with the data that tell the brilliant story of our Commonwealth, and, above all, of her progressive, wide-awake, and up-to-date merchants.

"Our city ranks next to St. Louis in population, but she stands upon an equal footing with her in all of the characteristics that go to make up an enterprising community. Baltimore sends greetings to St. Louis and hopes that this Exposition will prove advantageous to her, and be an inspiration that will yield fruit in the future.

PLUCK AND ENERGY AFTER THE FIRE.

"A great fire swept away the very heart of our city on the 7th of last February, destroying property valued at $75,000,000. Our people, with a courage and grit unsurpassed, turned at once to the task of restoration and worked with a vim, so that to-day the work of reconstruction is so well under way that within a year a new, substantial, and beautiful city will have been built upon her ruins, thus demonstrating that our people are of that type that knows no failure or discouragement, and who can meet with stout hearts any emergency.

"Without aid, but with warm sympathy from every quarter, our merchants have rehabilitated themselves, taken care of their customers, and pushed forward Baltimore's fame.

PRIDE OF MARYLANDERS IN MARYLAND.

"These facts about Maryland justify the love that every Marylander bears for his native State. He can point with pride to her record of patriotism, to her contribution to the progressive work of the world, to her statesmen, her soldiers, her sailors. Her sons and their descendants have furnished much of the brain and brawn which have contributed to the 'Winning of the West.'

"Missouri is a large debtor to Maryland. Many of her sturdy, enterprising, wide-awake business men are of Maryland stock or natives of our State. We are proud of such sons. They reflect credit upon their Maryland ancestry."

General Baughman's address was as follows:

"MARYLAND'S CONTRIBUTION."

"The scene before us to-day is one calculated to inspire the mind and thrill the heart. This mammoth exhibition is an effort to give outward and visible expression to the progress, the glory, the material and social advancement of more than a hundred years. But no work, however great, can fully express it; no monument, however colossal, is adequate to body it forth. No country, no civilization, no advancement in history approaches it. And yet there is somewhere a reason for it all, a cause for it, and an instrumentality by which, under the guiding hand of Providence, it was accomplished. What is it?

"Extent of territory does not make a great people. Multitudinous populations do not make a great nation; inexhaustible resources are often the cause of ruin and death. Only principle makes a people great; and the greater the territory, the larger the population, the more unbounded the riches, the more necessary is principle. But when a greatness of principle is joined to this material greatness, then all is made sublime. It was God's will that this nation should have both. But her essential greatness,—that which gives stamp and character to all—is greatness of principle. What is this principle?

"This nation was founded upon natural right and equity; upon liberty, equality, and fraternity rightly understood. And of all this progress, glory, advancement, riches, and splendor which we witness, this principle has been the life and the soul. And indeed, great is our glory, but no glory can add to it; great indeed, our progress, but this is its condition; great our riches, but this the greatest riches of all. Where did it come from? Who indicated it? Blessed shall he be forever in the memory of man!

"Now Bryce, in his 'American Commonwealth,' states that the fathers, the framers of the Constitution, possessed no inventive genius—did not invent anything. The wisdom which they were called upon to exercise, and did so wisely and so well, was the not less rare quality of wise selection from a heap of materials; and Mr. Alexander Johnson, in the *Princeton Review*, 1887, traces almost every article, provision, and enactment of the Constitution to one of the several Colonial Legislatures. The credit, therefore, of a principle may justly be given to the colony that first indicated it. Where did America get the principle? Who indicated it? Who pointed toward it? Who made it possible? For blessed shall that man or nation be forever in the annals of the human race. It came from Maryland—and as I speak that name my heart thrills with delight. Your's answer to mine, and together we exult over the glories of Maryland. The first indication in the New World of this principle was in Maryland. At a time when civil and religious liberty had perished in England, *she* resurrected both. She laid her foundation deep upon justice and liberty, not on the exercise of power. And this is her everlasting glory. Time has not lessened it nor bigotry diminished. Truth has been vindicated; and from the heights of civilization upon which we are placed, looking backward over the past to the dark period in which she was founded, she catches our eye—a luminous point in the universal gloom—a home of justice and liberty in an age of tyranny and oppression. The Dove of Peace flew away from the turmoil of England to a congenial home in Maryland; and the Ark of Safety brought over to our shores the principle of all future civilization.

"The Pilgrims landed in 1634, and within three years the first Assembly of Maryland was called. This Assembly was democratic and practically acknowledged the right of universal suffrage by extending the franchise to every freeman in the colony. 'The idea,' says William Hand Brown, 'was that of a purely popular Assembly, in which every freeman was to have a vote in person or by a personal, not a collective, representation.' Every freeman was called, and had the right to sit and vote (Life of Calvert, page 84). 'According to the writ of summons,' says Scharf, 'the Assembly was evidently intended to be purely democratic, *i. e.*, an assembly of the whole people.' The only ambiguity as to the right of suffrage is in the word freeman. But that, by a vote of the Assembly in 1642, is shown to mean a citizen above the age of majority, not held to personal service. 'The first Code of Maryland,' says Gen. B. T. Johnson, 'provided for the liberties of the people and for a general assembly for all freemen.' Maryland, therefore, from the very beginning, was essentially a democratic government, extending the privilege of citizenship and the right of franchise to all the people, simply requiring that they be of age and not indentured servants. Service seems to have been considered a kind of minority. 'The first Code of Virginia was a compilation of martial law,' continues the last-named author. It made no provision for the liberties of the people—did not guard them—and in the hands of an unscrupulous governor, as Doyle remarks, it might have become an instrument of the most oppressive tyranny. The first Code of Massachusetts and Plymouth was a theocracy, with a union of Church and State upon the basis of the Mosaic law. These three were the mother colonies. In Massachusetts and Virginia there is no provision for the liberties of the people. Democratic government is not hinted at in the most distant manner. But a greater glory is Maryland's. Lord Baltimore knew well that legislative freedom could not exist without liberty of conscience, and from the very beginning intended that both should obtain in Maryland. As far back as the days of Elizabeth, Catholic noblemen had cherished the idea of founding a colony that might be a home for persecuted Catholics; a home where they might openly profess and practice their religion and worship God according to the dictates of conscience. During the reign of Elizabeth, when the most savage bloody code ever conceived was in operation against them, Sir George Peckham and Thomas Gerard attempted to found such a colony on the coast of Maine. The expedition failed, but not the hope of success, which survived until it was finally taken up by George Calvert, first Lord of Baltimore, and executed by Cecil, the second lord of that title.

"All evidence, all documents, all the history in the case show that the idea of religious toleration was, from the beginning, the controlling motive of the Calverts, and that, backed by the Catholics of England and counseled and advised by others, they founded Maryland upon that principle. That it was not a matter of necessity is shown from the fact that he was made 'absolute lord and master of the Province.' That it did not originate with the Crown, is evident from the fact that it is found in no other charter. That it was an echo of an act of the Long Parliament, as claimed by Gladstone, is refuted by Johnson and Clarke. The idea had long been cherished by the Catholic noblemen of England, and for its establishment in Maryland, Calvert and his Catholic colonists deserve all the credit and merit all the glory. This is conclusively proven by General Johnson, by Davis, by Shea, by McSherry, and by Scharf. The same bigotry that overthrew the Proprietary Government and persecuted Catholics every time it was sufficiently strong, has continuously endeavored to rob the Calverts of this honor. But as they had the greatness of soul to return good for evil, and to bless those who persecuted them by re-establishing religions liberty every time they returned to power, so now every time their name is attacked a new vindication only makes their honor brighter, their names dearer, and their fame the more secure. It is a sublime spectacle and a history of which we may well be proud. A Catholic nobleman, at a time when his faith was prescribed in England, and priests and laymen were hanged, drawn, and quartered for the practice of it, as late as 1628, founds a colony upon religious liberty; throws open the doors of his domain to the world, and in an age of fierce intolerance directed chiefly against Catholics proclaims religious toleration. 'Then and thus,' says McMahon, 'landed the pilgrims of Maryland.' And then and thus were laid the foundations of the old city of St. Mary's and of our present State. 'And religious liberty,' says Bancroft, 'obtained a home, its only home in the wide world, in the little village which bore the name of St. Mary's. Such were the beautiful auspices under which Maryland was established. Its prosperity, its peace seemed secure. Its history is the history of benevolence, gratitude, and toleration.' 'Calvert,' again says Bancroft, 'deserves to be ranked among the most wise and benevolent lawgivers of all time. He was the first in the history of Christianity to seek for religious security and peace by the practice of justice and not by the exercise of power; to plan the establishment of popular institutions with the enjoyment of liberty of conscience; to advance the career of civilization by recognizing the rightful equality of the sects. The asylum for Catholics was the spot where, in a remote corner of the world, on the banks of rivers which had hardly been explored, the mild forbearance of a Proprietary adopted religious liberty as the basis of a State.' Such was the foundation of Maryland; and while Catholics and Quakers were persecuted in New England, and Puritans and Catholics in Virginia, and the most odious tests were established, Maryland, Maryland—with great pride and exultation be it said—Maryland proclaimed religious liberty for all Christians within her domain. The oath which Baltimore required the Governor to take, bound him by that solemn obligation not to exact or consider any religious qualification in the appointing to office or in the bestowal of honors; in which it is easy to see the law that Congress shall institute no religious test. It is true that the letter of the law contemplated only Christians; but all those who would live peaceably and not openly insult the Christian religion, as McSherry and Davis state, were included in its spirit. The subsequent practice of the government protected the unbeliever, and the Act itself forbids 'the application in a reproachful sense, to any person or persons whatsoever, any name or term relating to religious matters.' The urgent necessity was to protect Christians from Christians, and we have evidence of one Jew who lived unmolested in the Province.

"Such is the beginning of civil and religious liberty in Maryland. These principles have been made the very foundation of our government. 'The Constitution of this Assembly,' says Scharf, 'is one of the most interesting facts in the history of the country. It is easy to see in it the germ of all future political organization.' 'These regulations,' says Johnson, 'were as wise, as statesmanlike, as far-reaching as any lawgiver ever dictated to a distracted and faction-torn State. These institutions, this policy has become fundamental in all American Commonwealths, and are being recognized as those alone on which civilization can be developed.'

"Such is Maryland's contribution to the work and the scene before us; and whilst her children give all credit to other States, they have a special pride and a special glory in the work of the Land of the Sanctuary."

Gen. Joseph Lancaster Brent, Deputy Governor General for the State of Maryland of the Society of Colonial Wars in the United States, spoke, in part, as follows:

"Among the many happy influences that have combined to promote the vigorous growth of our people, we ought to give great, if not the greatest, prominence to that of the Colonial people of the Revolution generation who won our independence by war and secured our liberties in peace by wise political institutions.

"We, the people of Maryland, look back, through a period of 270 years from to-day, to find that the beginning of our political existence on this continent began on March 25, 1634, and we can readily infer the extent of the influences of the long Colonial period which have been impressed on us by our sturdy ancestors, which even to this day exercise control over us.

"The early settlers of the thirteen Colonial States encountered substantially the same environment, which, to a very great extent, resulted in developing almost identical love of personal liberty and the exercise of that self-control which alone gives liberty that moderation and restraint which constitute it the guarantee of happiness and prosperity.

"It was this strong, energetic, and courageous people that won our national independence; that, then, brought together in union the thirteen Colonial States, with their conflicting interests and views, and adopted that Constitution of the Republic which during the period of 114 years has proven itself able to develop the freedom, happiness, and prosperity of our people, and which to-day maintains in successful operation a Government containing the largest population of freemen and the broadest area of territory that has ever existed in the history of the world as a Republic resting upon popular suffrage.

"But the winning of our independence and the establishment of our Constitution are not the only benefits given us by the last Colonial generation of our founders, but to them we are also indebted for setting into operation the political machinery of our National Government and for the adoption of the broad policies that have advanced us along the pathway of progress, including the Louisiana Purchase, which this Exposition commemorates.

"I believe that the generation of American Colonials of which Washington was leader, soldier, statesman, and type, has achieved more political results than any single generation of men that ever lived.

"Other generations of men have fought with equal courage and patriotism in liberating or defending their country, but to the Colonial-born men of the age of Washington it was given, not only to show courage in war, but the rare constructive capacity of forming a written Constitution upon original lines, reconciling liberty with law, and of starting into operation a Government organized under it, and of impressing their wisdom and policies upon its administration with such force that for more than a century it has continued to secure the happiness of the people and the admiration of the world.

"In conclusion, I declare my belief that the Colonial societies, composed of the descendants of Colonial fathers, in seeking to preserve the history and the spirit of the forefathers, are doing a patriotic work of vast importance, and even of necessity, to our country, because it seems that so long as the country recognizes and accepts the wisdom of the Colonial founders of the Republic and safely guards the Constitution formed by them, to that extent only will be secured the stability and happiness of our Republic; but if, departing from this solid foundation wrought by Colonial statesmen, we become seekers after visionary ideas and adopt new principles, especially those adding unnatural powers to the Government, whereby the just equilibrium between power and freedom is destroyed, we will have entered upon th road of decadence, leading to disaster and the destruction of the only Republic founded upon popular suffrages, which, up to this date, has proven itself the best qualified and most enduring political agency for securing the happiness of a free people which the world has ever looked upon."

Reception at the Maryland Building.

On the evening of September 13 the Maryland Commissioners gave a reception at the Maryland Building to Governor and Mrs. Warfield.

The building was beautifully decorated with flowers and gracefully draped with flags. The reception was largely attended. The guests asked to meet the Governor and Mrs. Warfield were received by the Maryland Commissioners and their wives, assisted by Adjutant-General Riggs, Secretary of State and Mrs. Oswald Tilghman, Mrs. Daniel Manning, chairman of the Board of Lady Managers of the World's Fair, General and Mrs. Frank H. Hambleton, General and Mrs. John M. T. Finney, Colonel and Mrs. Richard S. Hill, Colonel and Mrs. Joseph L. Wickes, Miss Warfield, Miss Symington, Miss Tilghman, Miss Annie C. Thomas, Miss Baughman, Miss Cromwell, Miss Hoopes, Miss Mary Warfield, Miss Nicodemus, and Mrs. Edward N. Rich.

The splendidly decorated and illuminated building, the many gorgeous full-dress uniforms of the members of various military organizations present, the host of beautiful women there formed a scene of loveliness never to be forgotten by those who were fortunate enough to be present, among whom were the following:

Hon. Joshua W. Hering, Mrs. Hering, Miss Florence Macubbin, Miss Howard, Mr. Samuel M. Shoemaker, Miss Clayton, the Misses Pearce, Mrs. Orlando Harrison, Mr. and Mrs. James P. Gorter, Mrs. Murray Vandiver, Hon. R. W. Wells, Judge Henry D. Harlan, Mrs. Harlan, Mr. Thornton Rollins, Mr. C. A. Councilman, Mr. W. A. Marburg of A., Hon. Gordon T. Atkinson, Mrs. Atkinson, Miss Horsey, Mrs. F. P. Stieff, Mr. F. P. Stieff, Jr., Mr. A. L. Towson, Prof. J. B. Norton, the Misses Robinson, Hon. W. Lee Carey, Mrs. Carey, Mr. Chas. C. Macgill, Mrs. Macgill, Miss McGrath, Hon. M. V. Brewington, Hon. W. F. Porter, Mrs. Porter, Miss Hargis, Miss Helen G. Moore, Mr. Reuben Foster, Mr. and Mrs. Thos. J. Ewell, Hon. John Hubert, the Misses Hubert, Mr. Samuel J. Twilley, Mr. Robert Burton, Mr. Wilson Patterson, Hon. Carville D. Benson, Hon. Clarence W. Perkins, Judge Samuel D. Schmucker, Mr. Marion T. Hargis, Prof. Edward B. Mathews, Mr. C. H. Forrest, Mr. James Bond, Mr. Walter W. Crosby, Hon. Francis V. King, Mr. J. M. Street, Hon. Robert H. Carr, Miss Alice Key Blunt, Mr. Parker D. Dix, Mr. T. Lee Slingluff, Mr. B. F. Bond, Mr. Charles E. Ford, Mrs. Ford, Mr. George W. Knapp, Mrs. Knapp, the Misses Knapp, Mr. Frank Hoen.

Photograph by Aimé Dupont

MRS. MARY MARGARETTA MANNING

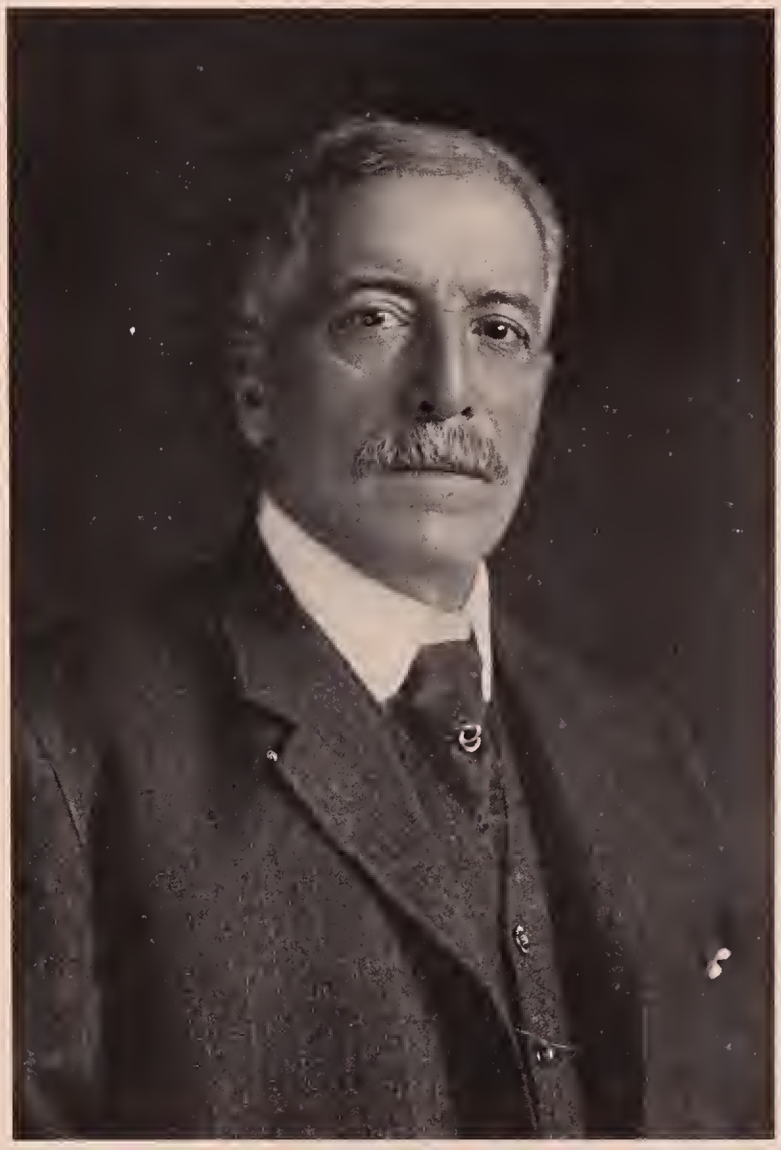
(Mrs. Daniel Manning)

President of the Board of Lady Managers, Louisiana Purchase Exposition

RECEPTION TO ADMIRAL SCHLEY.

The last large formal social function to be held in the Maryland State Building, and one of the most successful, was the reception given to Admiral and Mrs. Winfield Scott Schley by the Maryland Commission on the afternoon of November 25, near the close of the Exposition.

Admiral Schley was most graciously received by the residents of St. Louis and by the visitors to the Fair, and the reception to him at the Maryland Building was an ovation. Most of the foreign attaches and the State Commissioners were present, in addition to the Governor of the State of Missouri, President Francis, Ex-Congressman John Allen, General Bates, and a number of members of the Maryland Society. The guests were received by Mrs. Fisher, Mrs. Daniel Manning, president of the Board of Lady Managers, Mrs. Herman Stump, General L. Victor Baughman, Mr. William H. Lee, and Mr. Samuel K. Dennis.



Photograph by Hosch

WILLIAM H. LEE
Member Maryland Society of Missouri

CHAPTER VI.

The Agricultural Exhibit in Agricultural Building.

Mr. W. L. Amoss of Harford County was placed in direct charge of the agricultural exhibit and he applied himself for nearly eighteen months with energy and success to the difficult task of collecting, installing, and maintaining an exhibit from Maryland with but a limited amount of money at his command which compared favorably with the exhibits from some of the other States which exceeded ours many times over in cost. Every ounce of material for the exhibit had to be selected, and assembled. Nothing of the kind was attempted by the State either at Buffalo or at Charleston and there was no nucleus for the Agricultural Exhibit as there was for the Geological Exhibit. Mr. Amoss was assisted in arranging the exhibit by Mr. Stewart B. Shaw of Somerset County, Mr. John A. Scott of Baltimore County, and Mr. Leo Cahill of Washington County.

We also wish to acknowledge the obligations your Commission, and indeed all the people of the State, are under to the officers and trustees of the Maryland Agricultural College for their encouragement and aid, cheerfully and freely rendered. Through the courtesy of the trustees Mr. Amoss was permitted to devote himself as far as was necessary to collecting material for the exhibit. Every assistance possible was given by the president and faculty of the college and the director of the Experiment Station, where the products were received and stored preparatory to shipment to St. Louis. Professor W. T. L. Talliaferro, assisted by Professors Norton, Austin, Simmons, Walls, and Doane volunteered their services as receiving agents.

A detailed description of the Agricultural Exhibit is not necessary for the purposes of this report, however interesting and instructive it might be. It is sufficient to say that the Maryland Agricultural Exhibit proper at the Louisiana Purchase Exposition filled Block 45 on the southeast side of the Agricultural Building, and covered a floor space 90 x 20 feet.

Photograph by Jeffres

WM. L. AMOSS

The exhibit occupied an advantageous position and in design was both original and attractive; the object being to present the chief agricultural characteristics of the State, in a way so graphic that the attention of all passers by could not fail to be arrested; and so simple that the most hurried observer would be certain to receive some definite and lasting impression of Maryland's natural advantages and agricultural resources.

VIEW OF GENERAL AGRICULTURAL EXHIBIT

The attention of the visitor to the Agricultural Building was probably first attracted to our exhibit by a banner high above all other State banners, surmounting the Maryland Exhibit and bearing the word "Maryland" in gold letters 17 inches high and 20 feet long. Below was placed a map of the State, 7 x 12 feet in size.

Many of the exhibits were housed in handsome weathered oak cases with plate-glass fronts and manufactured by J. C. Knipp & Sons. All products were exhibited with the names and addresses of the growers attached and tied by ribbons in the State colors.

One case was devoted to specimens of forage crops. Timothy was shown from the farm of the Consolidated Coal Company near Frostburg, Allegany County, in two lots, the first and second crop from the same field. The second crop was quite four feet long and proved the wonder-

FRONT VIEW OF MARYLAND CORN EXHIBIT

ful fertility of the Alleghany Mountain pockets. Another specimen over five feet long was from the farm of J. T. Hoopers of Harford County, and as it was explained grew on land which often produced 100 bushels of corn per acre. Specimens of three varieties of clover, alfalfa, buckwheat, and spring wheat showing a growth of four and one-half feet of straw, for W. H. Weber & Sons of Garrett County were shown. Another case was devoted to forage crops such as winter wheat, barley, oats, cow peas, soja beans, and blade fodder successfully grown on the Eastern Shore and Southern Maryland.

Two cases for exhibiting 10 samples of soils and sub-soils, collected by Dr. J. A. Bonsteel of the U. S. Division of Soils for the Maryland Exhibit were located, one at each end of the space, with cards appended

BACK VIEW MARYLAND CORN EXHIBIT

calling attention to the fact that "Maryland has a greater variety of soils than any other State in the Union," and giving concise and accurate information concerning each sample exhibited; where obtained, characteristics, and a list of crops for which it is best adapted.

One original method adopted to illustrate the varied conditions, crops, and methods which obtain in the western and eastern sections of the State were the two typical "barn scenes" located at opposite ends of the Agricultural Exhibit block against the wall of the Agricultural Building. This consisted of two miniature barns, one labeled "Western Maryland Barn" and the other "Southern Maryland Barn." Each was filled with the finest specimens of the crops and farming utensils peculiar to its section, and each was surrounded by native trees, fruits, flowers, and vines. The whole was gracefully arranged and attracted much attention.

The display of tobacco in process of curing and of cotton grown in St. Mary's County was instructive even to our own people.

Our corn exhibit was representative and especially successful, comparing favorably in quality with any exhibit from the so-called corn States. The exhibit consisted of samples of ten ears each, tied in the State colors, with the names and addresses of the growers attached, housed in a handsome case with a plate-glass front. There was also displayed in jars a comparative analysis of Maryland corn high in protein for which as well as for valuable assistance in many other ways the Commission is indebted to Professor H. J. Patterson of the Maryland Experiment Station. Here, too, was displayed a diploma awarded by the Paris Exposition in 1889 to "Sir" J. P. Silver, of Harford County for corn exhibited by him. A second exhibit of corn, which often caused remark and expressions of surprise that Maryland could produce such crops, was placed in a special exhibit in the middle aisle of the Agricultural Building, where the four American staples, tobacco, sugar, corn, and cotton were shown.

The tobacco exhibit like the corn exhibit was displayed in a cabinet. It made an interesting and advantageous showing of the planters' tobacco from Southern Maryland and from Frederick County. The broad, membrane-like leaves readily caught the eyes of the visitors, who frequently expressed their admiration of the exhibit. A special tobacco exhibit was also made in the middle aisle covering a space twenty feet square. In the center of the space a giant tobacco Indian stood on a pedestal over seven feet high with a great pipe in his mouth and the "horn of plenty" on his arm, from which the manufactured products of the weed fell to the ground. To the right and left were cases in which on one side were displayed the several types of tobacco sold on the Baltimore market and which were contributed by the Tobacco Leaf Association, while on the other side was a duplicate exhibit of the Southern Maryland planters.

ONE VIEW OF MARYLAND TOBACCO EXHIBIT

On the front of the pedestal in tobacco leaf was the word "Maryland." The display of both leaf tobacco and manufactured tobacco was full and highly creditable.

The dairy industry of Maryland was not neglected, although for obvious reasons, a display commensurate with its value and importance was impossible. Your Commission was obliged to content itself with a representation of a Maryland dairy built of staff, looking cool and clean, and furnished with all the utensils found in a dairy as well as a fine exhibit of milk from Mr. Samuel M. Shoemaker's Walker-Gordon Dairy and the New Hygeia Dairy.

The Canned Goods Exhibit was also in the agricultural section, and was arranged in three groups of pyramidal form, composed of cans of peas, corn, and tomatoes. Over each group was advertised the fact that the United States Census of 1900 shows that Maryland packs one-fourth of all the peas, one-eighth of all the corn, and one-third of all the toma-

VIEW OF MARYLAND TOBACCO LEAF EXHIBIT

toes packed in the United States. Between each pyramid was a shield covered with orange cloth, with cans of small fruit arranged and attached to the face of each, while over and above all, to the right and to the left, were two globes, five feet in diameter, on pedestals of cans, with the outline of the two hemispheres. To the front and at the end of each wing stood a pyramid of cans on pedestals, one of crabs, the other of oysters.

In front of these were two extension tables bearing a load of big-stemmed sweet potatoes, and a card conveying the information that "These potatoes were grown on land 20 miles from Washington, bought eight years ago for $3.38 per acre." Few visitors passed without expressing interest and surprise at the statement as well as at the potatoes.

To the right and left of the center of the exhibit were two pyramids each 12 feet high and 8 feet wide at the base. On one was displayed manufactured animal products and on the other manufactured vegetable

MARYLAND MANUFACTURED TOBACCO EXHIBIT

products. Statistical information was given in bold letters on the face of each to the effect that Maryland has 460,000 farms, with an acreage of 2,032,000, and an annual total value of farm crops of $30,-217,000, and the eight steps of the vegetable manufactured products were adorned with the statement of the value of each product to the State as follows:

Small fruits	$1,224,000
Potatoes	1,337,000
Orchard fruits	1,416,000
Tobacco	1,438,000
Miscellaneous products	1,792,000
Vegetables	4,354,000
Hay and forage	4,709,000
Wheat	6,484,000
Corn	7,463,000
Total value	$30,217,000

The pyramid of animal products had five steps with the following information:

Honey and wax	$ 39,000
Wool	143,000
Poultry and eggs	3,650,000
Pork, beef, and mutton	4,546,000
Dairy products	5,229,000
Total value	$13,607,000

A picturesque pavilion, or arbor, built of laurel by Robert Cremen & Sons of Baltimore, and comfortably furnished with seats, added to the attractive appearance of the Maryland space and provided a convenient and much appreciated resting place for the visitors passing that way. Here the latest Maryland papers, the register for visitors, advertising circulars of Maryland real estate agents, extracts from the census reports, publications issued by the Maryland Bureau of Immigration, in short all sorts of printed advertisements of our State likely to attract favorable attention were to be found. Visitors crowded this arbor and frequently as many as 300 people from all parts of the globe registered in the visitors' register in a single day. To each visitor pamphlets issued by the Maryland State Bureau of Immigration, "Maryland As It Is," by Mr. Norval E. Foard, and many other publications were given. In this way a mass of choice advertising material was placed in the hands of thousands of visitors.

Though the arrangement and display of the products of the State were convincing, nothing, probably, left with the visitors a happier and more lasting impression of Maryland than the five wonderful snap-shot landscape photographs five feet long and sixteen inches wide, taken by

LATERAL VIEW OF MARYLAND GENERAL AGRICULTURAL EXHIBIT

Mr. J. W. Schaefer of Baltimore with his patent panorama camera on films especially prepared by the Eastman Kodak Company and colored by Miss E. S. Jackson of Washington, D. C. Two photographs, one colored and the other not, were taken from Braddock Heights, and lays before the visitor a view of Middletown Valley, a strip of exceedingly fine land in Frederick County, sixteen miles wide and fifty miles long, extending across the State from Mason and Dixon's Line to the Potomac River. Another was a typical plantation scene, the home of the late

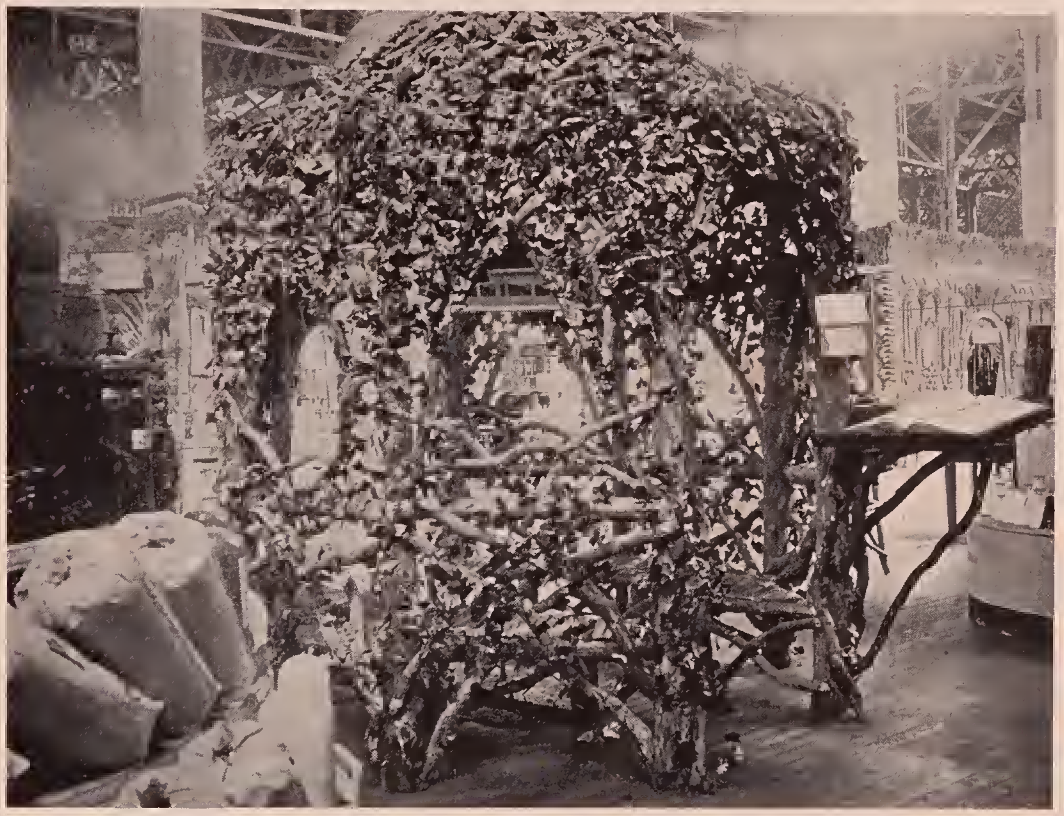
CANNED GOODS EXHIBIT

Judge Thomas Iglehart, " Indian Range," which is located about twelve miles from Annapolis, not far from the South River, and on the line of the proposed Baltimore and Southern Railroad. A card attached to the photograph gave the information that the land in that section is naturally fertile and can be bought at a price ranging from ten to thirty dollars per acre.

The fourth photograph was a marine view, and was taken from the top of Mr. Monday's barn on an inlet of the Choptank River, three miles from Cambridge, and the fifth was also a marine view taken off Solomon's Island and showing the wonderful harbor afforded by the Patuxent River covered by a fleet of oyster boats.

A competitive display was not the purpose of the Maryland Exhibit. Its object was to appeal to the home-seekers, and every effort consistent with the resources at the command of your Commissioners was made to arrange the products of the State in such quantities and order as to make the exhibit representative and comprehensive, in character, and convincing the visitor that the State of Maryland in climate, soil, and natural characteristics presents more advantages than any other State in the Union. Your Commission is encouraged to believe from subsequent events that this was the proper policy. The appropriation of 1904 came too near the opening of the Exposition to allow time for assembling a bulky exhibit, even had the State been more generous. Specimens for the exhibit had in most instances to be bought in the market and since only the choicest articles were desired the highest prices had to be paid. It is a matter of surprise and regret to your Commission, and unfortunate for the State, that there was not a more generous response by the farmers and manufacturers of farm products of the State for products. It is to be regretted that apparently our people were not fully alive to the necessity of advertising their State and their own goods and the wonderful opportunity afforded by the Exposition to do so.

Your Commissioners in spite of the expense of collecting and installing the Agricultural Exhibit, due largely to the frightful cost of labor and materials at the Fair, and many other difficulties are gratified at the successful result. The awards given exceeded our expectations; and our exhibit not only compared favorably with other states on account of the diversity of our exhibits, but in many instances surpassed them. This statement is conclusively proved by the fact that our awards in number and grade, will bear favorable comparison with any State expending the same amount of money and in some instances much more than was done by Maryland.



ORNAMENTAL ARBOR, MARYLAND AGRICULTURAL EXHIBIT

It is hoped by your Commissioners that in addition to the proximate object of the exhibit in advertising the State at the great Exposition an incidental, though tangible and permanent benefit may result to the State in having the bulk of the exhibit placed in the custody of the Maryland Agricultural College, to be used by it. Except a few donations to museums and the St. Louis Orphan Asylum after the Fair the whole exhibit was returned to the Agricultural College.

Appended is a list of the awards by the International Jury of the

Louisiana Purchase Exposition to the Maryland Agricultural Exhibit and its Exhibitors:

Grand—

Maryland Commission—tobacco.

The American Tobacco Company, Baltimore—manufactured tobacco.

Gold for Tobacco—

Patuxent Planters' Club, Marlboro.

Leaf Tobacco Association, Baltimore.

Samuel Cox, Jr., Bel Alton.

John H. Drury, Chaney.

W. L. Purdum, Monrovia.

Ruben Bowen, Parran.

W. L. Amoss, Director Agricultural Exhibit.

Gold—Agricultural Products—

Maryland Commission.

State Experiment Station, College Park—hay and forage products.

W. L. Amoss, Director of Agricultural Exhibits.

Joseph T. Hoopes, Bynum—timothy and alfalfa.

H. C. Hollaway, Newark—corn.

D. Columbus Kemp, Frederick—grains.

John Snowden, Bowie—wheat.

M. B. Waite, Woodwardville—sweet potatoes.

Cambridge Manufacturing Company, Cambridge—flour, meal, hominy.

Staley Manufacturing Company, Baltimore—cornstarch.

Martin Wagner & Co., Baltimore—canned goods.

Dickey & Co., Baltimore—wool.

Silver for Tobacco—

Franklin Weems, Marlboro—leaf.

Estep Stewart, Chaney—leaf.

Charles T. Chaney, Chaney—leaf.

Hugh Wills, La Plata—leaf.

Photograph by Mesny's

ALBERT JONES

Representative Maryland Commission, Executive Commission, Louisiana Purchase Exposition

Silver for Cereals, etc.—

Maryland Commission (collective corn exhibit).
W. F. Allen, Salisbury—seeds.
Eugene P. Childs, Riverview—peas.
David Engler, Jr., Medford—rye.
W. S. Flood, Knoxville—wheat.
A. C. Kolk, Long Green—wheat, sunflower seed, corn.
Upton Mehring, Rocky Ridge—rye.
James T. Moore, Sandy Spring—wheat.
A. P. Silver, Glenville—corn.
Scott Snook, Hagerstown—clover seed.
V. M. Stones, Smithsburg—millet.
Nelson Wilhide, Thurmont—wheat.
H. Weber & Sons, Oakland—cauliflower.
John Charles, Charlton—flour.
George H. Shultz, Binwood—hominy.
T. M. Felton, Frederick—hominy.
Maryland Commission—canned goods.
W. W. Bradford, Emmorton—canned tomatoes.
H. F. Hemmingway & Co., Baltimore—canned fruits and vegetables.
B. F. Shiver & Co., Union Mills—canned vegetables.
John Boyle & Co., Baltimore—preserves.
Gibbs Preserving Co., Baltimore—jams and jellies.
Irving Preserving Company, Baltimore—catsup.
J. G. Harrison & Sons, Berlin—nursery stock.

Bronze for Leaf Tobacco—

Frank Hill, Upper Marlboro.
S. E. Russell, Leonardtown.
E. E. Berry, Foustville.
Charles V. Hayden, Leonardtown.
F. Snowden Hill, Marlboro.
Thad. Yates, Leonardtown.
George W. Brooke, Marlboro.

Photograph by Ilgenfritz

SAMUEL K. DENNIS
Secretary Maryland Commission

Bronze for Various Exhibits—

Robert Cremen & Sons, Baltimore—rustic furniture.

Anna S. Hill, Leonardtown—hand-knit socks from Maryland cotton.

John H. Drury, Chaney—corn-husk collars.

J. S. Bartow, Easton—grain.

George E. Bishop, Hoyes—oats, buckwheat.

John H. Drury, Chaney—corn blades.

Jas. Elzey, Salisbury—sweet potatoes.

Samuel Enfield, Forest Hill—corn.

Otto Fisher, Avilton—buckwheat.

Geo. R. Garnaud, Smithsburg—wheat.

E. O. Garner, College Park—wheat.

A. P. Gorman, Laurel—corn.

Thomas B. Harper, Hurlock—corn.

J. T. Hoopes, Bynum—corn.

H. S. Hurley, Pocomoke City—sweet potatoes.

Fred. Von Kappf, South Towson—corn.

Frank P. Little, Hancock—wheat.

G. T. Littleton, Beaver Dam—sweet potatoes.

A. McGill, Cordova—corn.

Joseph M. Mattingly, Beavue—corn.

E. T. Massey, Masseys—grass seed.

D. E. Oswald, Chewsville—wheat, oats.

Jim Reid, Linkwood—corn.

Noah Small, Bel Air—wheat, oats.

Dr. Augustus Stabler, Brighton—popcorn.

C. W. Thomas, Adamstown—corn.

J. S. Howard, Rutland—cow peas.

Clayton Wright, Centerville—corn.

Mrs. George T. Chambers, Cove Point—canned fruit.

Gibbs Preserving Company, Baltimore—canned fruits and vegetables.

George D. Insley & Sons, Bivalve—crab meat.

Kidwell Bros. & Co., Baltimore—preserved strawberries, vegetables.

H. J. McGrath & Co., Baltimore—pineapple and peas.
J. M. Mitchell, Harford County—sugar corn.
Frank O. Smith, Dunkirk—canned tomatoes.
David Kerr, Baltimore—potato chips.
Silas C. Beachy, Bittinger—maple sugar and syrup.
C. E. Whittington, Dunkirk—decoys.

CHAPTER VII.

The Exhibit of Maryland Mineral Products in Mines and Metallurgy Building.

The exhibit of Maryland's mineral resources occupied a conspicuous position at the southern end of the Mines and Metallurgy Building. It covered an area of over 2000 square feet of floor space together with 4000 square feet of wall and window space, the combined area being surpassed by but few other states.

The exhibit was planned and installed for the Commission by Professor Wm. Bullock Clark of the Johns Hopkins University, Chief of the State Geological Survey, assisted by Professor Edward B. Mathews and several other associates. The materials forming the display were gradually accumulated over several years, those first collected forming the State's exhibit at Buffalo in 1901, and these further augmented constituting the Charleston exhibit later. The St. Louis exhibit was largely increased over the previous displays and was thoroughly representative of the varied mineral resources of the State. The exhibit won the only Gold Medal awarded to any State for its collective exhibit of mineral resources at the Buffalo Exposition, and also received, among other awards, 12 special Gold Medals, twice the number awarded to any other State in mining, at the Charleston Exposition.

The exhibit was divided into a number of main groups: (a) mineral products, (b) systematic geology, (c) maps, sections, reports, and models, (d) highway materials and methods.

Mineral Products.—The mineral products were represented by the following: coals; building and decorative stones; ores; clays and clay products, including pottery, tile, terra cotta, fancy and common brick, fire-brick, enameled-brick, retorts, and stove-linings; limestones; sands; cement rocks; flints; feldspars; marls; tripoli; barytes; soapstone; etc. The total value of Maryland's production of these materials has been

DR. WILLIAM BULLOCK CLARK

gradually increasing in recent years until it now aggregates between nine and ten million dollars annually. The attempt was made to show the natural materials together with the various kinds of manufactured products derived from them. All of the leading operators and manufacturers in the State took part in the display, some of them supplying large collections of materials.

Many of the most important mineral products were arranged in the form of special exhibits. A large pyramid of blocks of coal, mainly from the Georges Creek valley, furnished by the Consolidation Coal Company, Black Sheridan and Wilson Company, Georges Creek Coal and Iron Company, American Coal Company, Piedmont Mining Company, Davis Coal and Coke Company, Garrett County Coal and Mining Company, Maryland Coal Company, New Central Coal Company, Phoenix and Georges Creek Coal Company, Monroe Coal Company, Moscow-Georges Creek Mining Company, Piedmont and Georges Creek Coal Company, and G. C. Pattison, was placed conspicuously near the center of the space. The large block forming the center of the pyramid was from the mines of the Consolidation Coal Company. In connection with this exhibit was a collection of glass jars filled with samples of coal from all the workable seams and a large vertical section showing the position of each seam in the Maryland Coal Measures. A large model also showed the distribution of the several coal seams in the various coal basins of the State.

Columns, slabs, and cubes of building and decorative stones, from the leading quarries of the State, were arranged both in the form of a pyramid and on tables, among them being granite from the quarries of McClenahan and Brother at Port Deposit, the Maryland Granite Company at Guilford, and the Guilford and Waltersville Granite Company at Granite; marble from the quarries of the Beaver Dam Marble Company at Cockeysville, the Washington Marble Company near Eakles Mills, and the Washington Junction Stone Company near Point of Rocks; sandstone from the quarries of the Seneca Stone Company of Seneca, and serpentine from those of J. H. C. Watts at Cardiff; also specimens from the numerous quarries in the vicinity of Baltimore and

GENERAL VIEW.

MARYLAND GEOLOGICAL SURVEY EXHIBIT, MINES AND METALLURGY BUILDING.

from many other points throughout Maryland. Some samples represented types of stone which have not been developed commercially as yet although occurring in large amounts. A booth made of slate furnished by the well-known Peach Bottom Slate Producers' Association and other interests in Harford County was a conspicuous feature of the exhibit.

Various iron and copper ores were displayed, particularly the historic carbonate iron ores worked in Baltimore, Anne Arundel, and Prince George's counties and smelted at the Muirkirk furnace of Charles E. Coffin, illustrating which were shown armor-piercing projectiles made by the U. S. Arsenal at Watertown, Massachusetts, and metal rolls made by the Philadelphia Roll and Machine Company. The hematite and limonite ores of the central and western counties were also effectively displayed.

In the clay exhibit was a large glass case filled with decorated pottery from the manufactories of the Edwin Bennett Pottery Company and D. F. Haynes and Son of Baltimore. A wall case contained a fine exhibit of enameled-brick from the works of Andrew Ramsay of Mount Savage. A central mantel-piece made of brick from Maryland clay was put up by the Washington Hydraulic-Press Brick Company to display its products and an exhibit of terra cotta and building bricks was made by the Burns and Russell Company and the Baltimore Brick Company of Baltimore. Fire-brick was supplied by the Union Mining Company of Mount Savage, and the Baltimore Retort and Fire-Brick Company of Baltimore and sand-brick by the Cumberland Granite Brick Company of Cumberland. A booth was covered with roofing-tile from Edwin Bennett's Roofing Tile Works of Baltimore and there was also a large exhibit of stove-linings from the Green Hill Fire Brick Company of North East. There were several other exhibits of clay products including brick, earthenware, and pottery. A large collection of the raw clays of the State, classified according to their various uses, was arranged in jars.

Among other materials displayed were limestone and lime from S. W. Barrick and Son of Woodsboro, Wm. C. Ditman of Texas, John W. Tabler Lime and Stone Company of Frederick, and the M. J. Grove Lime Company of Lime Kiln; cement rock and cement from the Cum-

Fig. 1. View Looking South.

Fig. 2. View Looking North.

MARYLAND GEOLOGICAL SURVEY EXHIBIT, MINES AND METALLURGY BUILDING.

berland Hydraulic Cement Company of Cumberland, the Round Top Cement Company of Hancock, and the Cumberland and Potomac Cement Company at Pinto; flint from the mines of the American Pottery Supply Company in Harford County, and feldspar from the mines of the Sparvetta Mining Company in Cecil County; also tripoli from the pits of the New York Silicate Company on the Patuxent River. There was also exhibited a collection of typical Maryland soils, explanatory of the agricultural soil maps that adorned the walls near by.

SYSTEMATIC GEOLOGY.—In addition to the exhibit of mineral products there was an extensive systematic collection representing the geology, mineralogy, and paleontology of the State displayed in a series of plate-glass cases on the walls. In this exhibit the numerous materials found at the various geological horizons of the State from the oldest (Archean) to the youngest (Pleistocene) were displayed with the object of emphasizing the great variety of geological formations represented, and the variety and extent, both developed and undeveloped, of the mineral products of the State.

MAPS, ETC.—A large collection of maps, geological sections, photographs, and illustrations covered the upper portions of the walls. They constituted a graphic panorama of the leading physiographic, geologic, soil, hydrographic, climatic, and economic features of the State. Colored transparencies of local scenery, and greatly enlarged microphotographs of the leading types of Maryland rocks occupied the windows. The publications of the Maryland Geological Survey filled one of the cases. Several models were displayed, the most important of these being one showing the relief of the coal basins of Allegany and Garrett counties and another of Baltimore and vicinity with the water and land approaches to the city.

HIGHWAY MATERIALS AND METHODS.—This display was designed to illustrate some of the materials and methods employed by the Highway Division of the Maryland Geological Survey. Photographs and drawings showing the testing laboratory and character of tests made were appropriately arranged together with samples of the materials used. The highway exhibit was the most complete one at the Exposition and

Fig. 1. Building-Stones, Granite, Marble, Slate, Etc.

Fig. 2. Decorative Stones, Marble, Serpentine, Etc.

MARYLAND GEOLOGICAL SURVEY EXHIBIT, MINES AND METALLURGY BUILDING.

fully represented the up-to-date methods which the State of Maryland has recently inaugurated.

Two original "Mason and Dixon Line" stones, a "crown-stone" and a "mile-stone" were also included in the Maryland exhibit, awakening great interest among the visitors to the Mines Building.

PUBLISHED INFORMATION.—The Maryland Geological Survey issued and distributed at St. Louis a pamplet containing "A Brief Account of Maryland Mineral Resources and Description of Exhibit of Maryland Mineral Products in Mines and Metallurgy Building, St. Louis, 1904." Several thousand copies of this publication were distributed to the public at St. Louis and from Baltimore. It has been much sought for by those desiring information regarding the mineral resources of the State.

The article at the end of this volume on the Physical Features of Maryland is a more elaborate discussion of the natural wealth of the State and is intended to meet the demands for more complete information regarding the material resources of Maryland. It has seemed desirable that the results of the work of the Maryland Geological Survey should be put in such form as to be readily available to those seeking information regarding the State. A large edition of this pamphlet will be prepared for distribution to those who do not obtain the complete volume.

Surmounting the entire exhibit and visible from all parts of the building was the great seal of the State in black and gold over which in gilt letters was the word MARYLAND, which could be clearly seen from all parts of the great building.

AWARDS.

Grand Prizes—

State of Maryland—Collective Mineral Exhibit.

Consolidation Coal Company, Baltimore—coal.

Hydraulic-Press Brick Company, St. Louis and Washington—brick (part of exhibit made of brick from Maryland clay).

Fig. 1. Coals, Flints, and Feldspars.

Fig. 2. Iron Ores, Cements, and Lime Products.

MARYLAND GEOLOGICAL SURVEY EXHIBIT, MINES AND METALLURGY BUILDING.

Gold Medals—

Maryland Geological Survey, Baltimore—publications.

Maryland Geological Survey, Baltimore—maps, sections, transparencies.

Maryland Geological Survey, Baltimore—building stones.

Maryland Geological Survey, Baltimore—clays and clay products.

Maryland Geological Survey, Highway Division, Baltimore—road materials.

Georges Creek Coal and Iron Company, Baltimore—coal.

Muirkirk Furnace, Muirkirk, Maryland—Iron ores and ordnance products.

Wm. Bullock Clark, Baltimore—Director Mineral Exhibit.

Silver Medals—

Union Mining Company, Mount Savage—fire-brick.

Andrew Ramsay, Mount Savage—enameled-brick.

Queen City Brick and Tile Company, Cumberland—press brick.

D. F. Haynes and Son, Baltimore—pottery ware.

Edwin Bennett Pottery Company, Baltimore—pottery ware.

Edwin Bennett's Roofing Tile Works, Baltimore—roofing tile.

Baltimore Retort and Fire-Brick Company, Baltimore—clay retorts, etc.

Maryland Coal Company, Lonaconing—coal.

Allegany County, Maryland—iron ores.

Prince George's County, Maryland—iron ores.

Charles E. Coffin, Muirkirk—iron ores.

McClenahan Granite Company, Port Deposit—granite.

Beaver Dam Marble Company, Baltimore—marble.

Peach Bottom Slate Producers' Association, Cardiff—roofing slate.

Seneca Stone Company, Baltimore—sandstone.

H. P. Reiger and Company, Baltimore—granite.

Washington Junction Stone Company, Point of Rocks—marble and sandstone.

Albert Weber, Baltimore—granite.

J. H. C. Watts, Belair—serpentine.

Fig. 1. Clay Products, Fire-brick, and Tile.

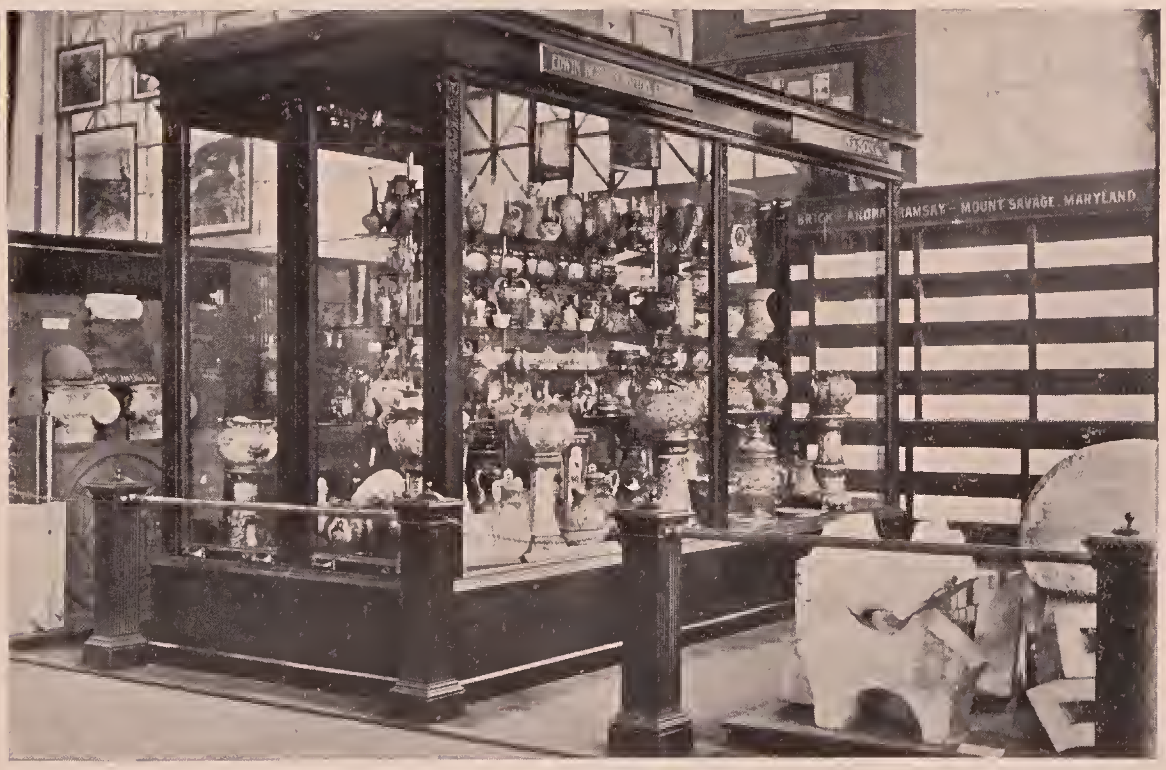


Fig. 2. Clay Products, Pottery, Terra Cotta, and Enameled Brick.

MARYLAND GEOLOGICAL SURVEY EXHIBIT, MINES AND METALLURGY BUILDING

M. J. Grove Lime Company, Lime Kiln—lime.

Edward B. Mathews, Baltimore—Collaborator of Mineral Exhibit.

Harry F. Reid, Baltimore—Collaborator of Mineral Exhibit.

A. N. Johnson, Baltimore—Collaborator of Mineral Exhibit.

Bronze Medals—

Maryland Granite Company, Baltimore—granite.

I. H. Peddicord and Son, Baltimore—granite.

Victor Perola, Point of Rocks—marble.

Piedmont Mining Company, Baltimore—coal.

Edward Kerr and Company, Robinson—Glass-sand.

Cumberland Granite Brick Company, Cumberland—sand-lime brick.

S. W. Barrick and Son, Woodstock—lump lime.

Round Top Cement Company, Hancock—cement.

FINANCIAL STATEMENT OF THE MARYLAND COMMISSION TO THE LOUISIANA PURCHASE EXPOSITION AT ST. LOUIS.

FREDERICK P. STIEFF, Treasurer.

THE FOLLOWING IS AN EXHIBIT OF THE FINANCIAL TRANSACTIONS OF THE COMMISSION FROM ITS ORGANIZATION UNTIL MARCH 19, 1906.

RECEIPTS.

State Appropriation	$65,000.00
Amount received by sale of furniture, etc., in State Building	395.00
Proceeds from sale of Fruit	75.40
	$65,470.40

EXPENDITURES.

AGRICULTURAL EXHIBIT.

Cost of collecting exhibit, installing same; freights; salaries of employes; expense of maintaining exhibit and returning same to Agricultural College	$10,089.23

GEOLOGICAL EXHIBIT.

Cost of collecting exhibit, installing same; freights; salaries of employes; expense of maintaining exhibit and returning same to State House, Annapolis, Md	7,500.00

JOHNS HOPKINS HOSPITAL EXHIBIT.	
Amount allowed by Commission for making Exhibit..........	$700.00
BUREAU OF IMMIGRATION.	
Amount allowed by Commission for pamphlets advertising the State of Maryland to encourage immigration..............	500.00
PLASTER OF PARIS SURGICAL JACKET EXHIBIT.	
Amount allowed by Commission for making Exhibit...........	100.00
STATE BUILDING.	
Cost of erecting and completing Maryland State Building.......	19,114.95
FURNISHING AND MAINTAINING STATE BUILDING.	
Cost of furniture and fixtures for the Maryland State Building; expense of light, fuel, water, and other incidental expenses of maintaining State Building...........................	3,653.86
Janitor service—salary and expenses.........................	511.05
Custodian Maryland Building—salary and expenses............	1,385.44
MARYLAND DAY CELEBRATION.	
Amount allowed Governor and Staff..........................	1,200.00
Expenses incurred by Commissioners and invited guests for traveling expenses, entertaining, and ceremonies on September 12, 1904......................................	6,523.96
Distribution of Maryland Fruit, Maryland Day................	431.84
SALARY OF SECRETARY..	1,750.00
EXPENSE ACCOUNT.	
Cost of printing, stationery, insurance, freights, traveling, and sundry expenses of Commission for Opening Day and arranging for Exhibits, and other incidentals................	8,531.40
FINAL REPORT.	
Cost of publishing and distributing final report of the Commission; estimated and not paid..........................	1,800.00
BALANCE—Estimated, and which is to be paid to State Treasurer....	1,678.67
	$65,470.40

CHAPTER VIII.

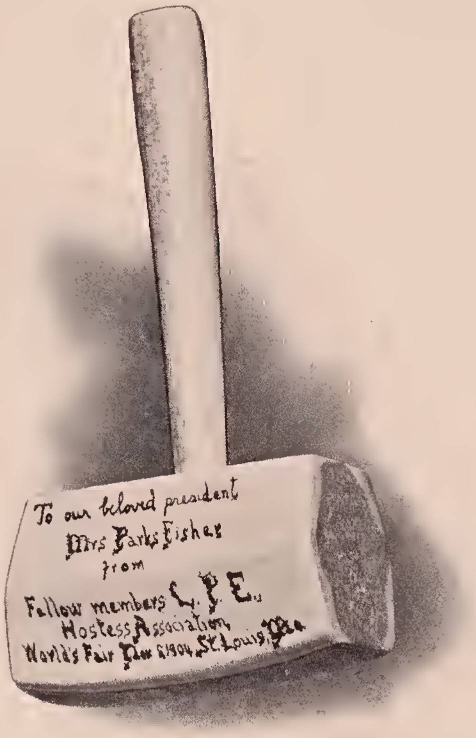
Conclusion.

The Louisiana Purchase Exposition is now a matter of history. It was easily the greatest of all international expositions and is not likely to be equalled for years to come, and possibly never surpassed.

With a modest appropriation Maryland was enabled to take a proper and creditable position in this heretofore unequalled demonstration, which was remarkable as the most general, elaborate, and enthusiastic

GOLD MEDAL PRESENTED MRS. FISHER
President Hostess Association

assemblage of the nations of the world and of the States of the Union ever had on any similar occasion. The Exposition was no less remarkable for the interchange of official courtesies and social amenities. Owing to our limited resources we were unable to attempt any entertainments on the elaborate scale inaugurated by many State and Foreign Commissions. The functions at the Maryland Building were uniformly dignified though comparatively simple, but were none the less successful. A number of set official receptions were given as before stated, and there were a number of impromptu and quasi-official occasions, which were somewhat original. In this class might be mentioned the reception at the Maryland Building to the Maryland Agricultural College Cadets who were encamped for several days on the Fair Grounds and Mrs. Fisher's weekly teas. We are, therefore, gratified to be able to report to your Honorable Body that in addition to the imposing array of medals and awards secured by our exhibits the representatives of the State of Maryland were the recipients of many marks of distinction and appreciation.



GAVEL PRESENTED MRS. FISHER
President Hostess Association

Mrs. Fisher of the Maryland Commission and hostess of the Maryland Building was a leader at the Exposition. She was the first to foster a spirit of personal friendship and sociability among those connected with the Exposition by bringing them all together at informal weekly teas at the Maryland Building. The acquaintances and friendships thus formed went far toward promoting official harmony and easy business relations as well as in making the Maryland Building popular. Mrs. Fisher was honored by her fellow hostesses in being elected President of the Hostess Association.

Your commission would be wanting in courtesy as well as in honesty, should we fail to acknowledge the part taken by the members of the Maryland Society of Missouri in the success of Maryland at the Exposition. The influence of the members of the Society was potent in securing privileges and recognition far beyond our expectations. The members of the society, of whom a list is appended, were most hospitable to all Marylanders visiting the Exposition, and the uniform consideration shown the members of your Commission and others by them should never be forgotten.

MEMBERS MARYLAND SOCIETY OF MISSOURI.

Messrs.—

R. J. LACKLAND,
WM. H. THOMSON,
WM. H. LEE,
JNO. F. LEE,
MURRAY CARLETON,
LEONARD MATTHEWS,
T. GARRISON MORFIT,
Y. H. BOND,
C. L. HILLEARY,
D. M. HOUSER,
R. S. BROOKINGS,
E. C. SIMMONS,
FRANKLIN RIDGELY,
F. J. MCMASTER,
JNO. H. TENNANT,
G. B. MILLER,
CHAUNCEY F. SCHULTZ,
WM. S. ZITTLE,
JNO. L. STORM,
P. S. BANTZ,
MOSES FRALEY,
CLARENCE L. HOBLITZEL,
JNO. C. MORFIT,
BARTOW VAN NESS,
ALLEN TRAIL,
GEO. TYLER,
J. H. TYLER,
M. B. MILTENBERGER,
W. C. BOOGHER,
E. G. CHERBONNIER,
E. C. LACKLAND,
T. H. L. LOUD,
WM. N. MATTHEWS,
LEONARD MATTHEWS, JR.,
CLAUDE L. MATTHEWS,
BERNARD GREENSFELDER,
S. M. SPARKLING,
C. H. THIEMEYER,
J. C. KILLINGSWORTH,
JNO. HALL CHRISTIE,
WM. S. WALKER,
ADAM WIEST,
CHAS. J. M. DONALDSON,
JNO. APPLER,

Jno. A. J. Shultz,
Enrique Parmer,
H. W. Beck,
Jesse L. Carleton,
Henry B. Louderman,
L. L. Prince,
W. S. Haddaway,
R. F. Combs,
Walter H. Beck,
M. M. Beck,
E. W. Warfield,
Jas. C. Morfit,
C. B. Beck,
Jacob Gross,
C. H. Wickard,
Jno. R. Thomas,
Carroll E. Hill,
T. P. Boland,
Jos. J. Gross,
J. R. Appler,
Chas. G. Blake,
Chas. R. Wolfe,
Ed. F. Macy.

REPORT

ON

THE PHYSICAL FEATURES OF MARYLAND

EMBRACING AN ACCOUNT OF THE

PHYSIOGRAPHY, GEOLOGY, MINERAL RESOURCES,
AGRICULTURAL SOILS, CLIMATE, HYDROGRAPHY,
TERRESTRIAL MAGNETISM, AND FORESTRY

AND ACCOMPANIED BY

A NEW GEOLOGICAL AND AGRICULTURAL SOIL MAP
OF THE STATE

PREPARED BY

THE MARYLAND GEOLOGICAL SURVEY
WM. BULLOCK CLARK, State Geologist

WITH THE ASSISTANCE OF SEVERAL MEMBERS OF
THE NATIONAL BUREAUS

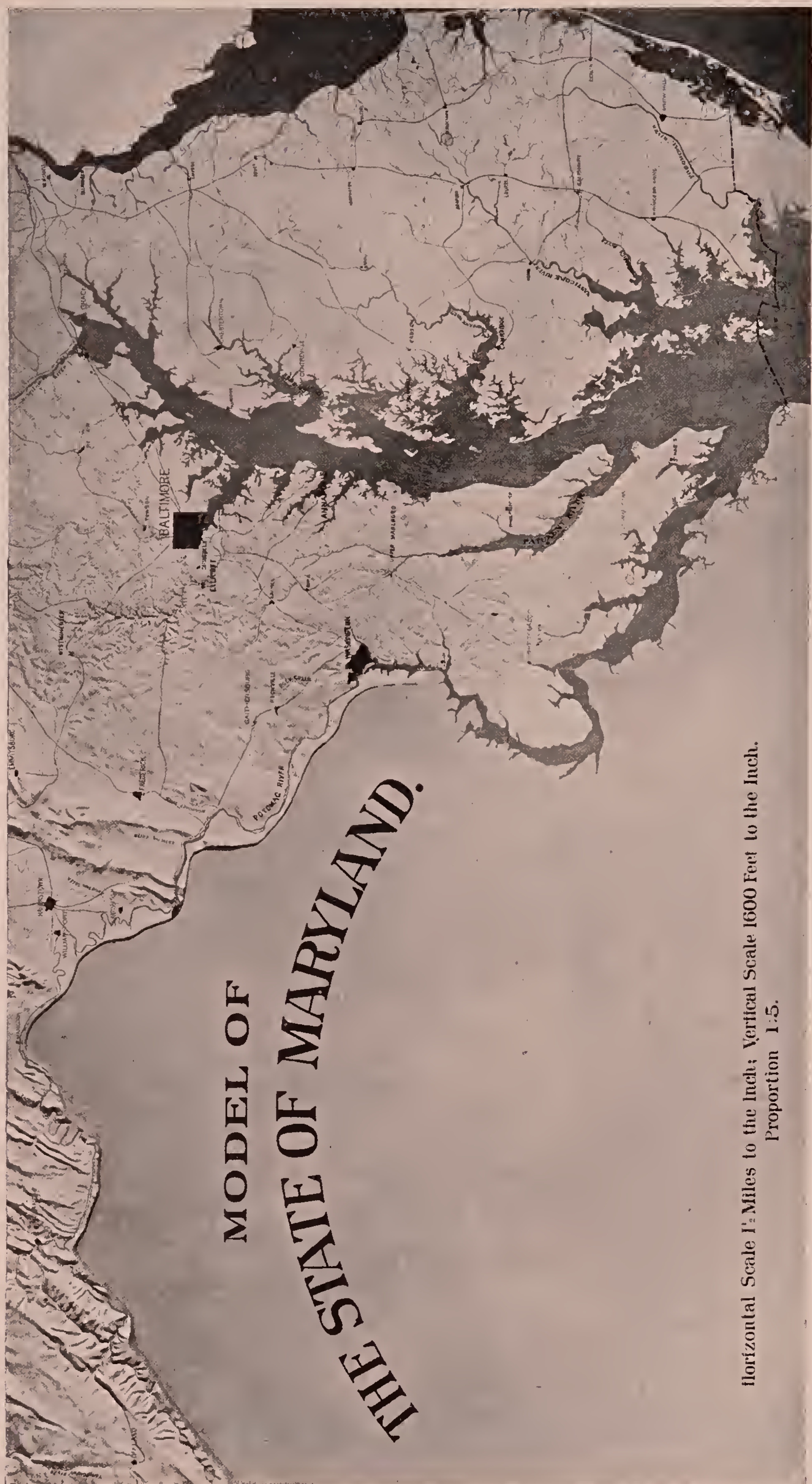
NOTE

This contribution to The Physical Features of Maryland has been made by the Maryland Geological Survey at the request of the Maryland Commissioners to the Louisiana Purchase Exposition to meet the demands for authoritative information regarding the State and to answer in detail the many inquiries resulting from the exhibit in the Mines Building at St. Louis. It puts in written and permanent form the records of that exhibit and will supply a need that has long existed.

The chapters entitled Introduction, History of Investigation regarding the Physical Features of the State, Physiography, Geology and Mineral Resources were written by Wm. Bullock Clark and Edward B. Mathews with the assistance of George B. Shattuck, Charles K. Swartz, Cleveland Abbe, Jr., and others of the Maryland Geological Survey. The chapter on Agricultural Soils was prepared by J. A. Bonsteel of the U. S. Bureau of Soils; that on Climate by Oliver L. Fassig of the U. S. Weather Bureau; that on Hydrography by F. H. Newell of the Hydrographic Division of the U. S. Geological Survey; that on Terrestrial Magnetism by L. A. Bauer of the U. S. Coast and Geodetic Survey; and that on Forestry by W. D. Sterrett of the U. S. Forest Service.

CONTENTS

ILLUSTRATIONS



VIEW OF MODEL OF THE STATE OF MARYLAND.

THE PHYSICAL FEATURES OF MARYLAND

EMBRACING AN ACCOUNT OF THE PHYSIOGRAPHY GEOLOGY, MINERAL RESOURCES, AGRICULTURAL SOILS, CLIMATE, HYDROGRAPHY, TERRESTRIAL MAGNETISM AND FORESTRY

PREPARED BY

THE MARYLAND GEOLOGICAL SURVEY

INTRODUCTION.

Location.—The State of Maryland, lying midway between the North and South, and stretching from the Atlantic Ocean to the crest of the Alleghanies, with the great estuary of the Chesapeake Bay and its tributaries extending far into the land in all directions, possesses many natural advantages in location over neighboring commonwealths. There is probably no state of equal size in the Union that has such a variety in its agricultural and mineral resources and in its sea and bay products, while its generally salubrious climate renders every section healthful as a place of residence. From its eastern to its western borders may be found a succession of districts suitable from their surroundings for the most diverse employments.

The State of Maryland is the most northern of the Southern States, and is situated between the parallels 37°53′ and 39°44′ north latitude and the meridians 75°4′ and 79°30′ west longitude, the exact position of the western boundary being still undetermined.

Boundaries.—The boundaries of Maryland are based upon both arbitrary locations and geographic features. Different interpretations of the descriptions of the limits of the early grants, such as "the land hitherto unsettled," and "the first fountain of the Potomac," led to disputes, some of which are still open. The northern, as well as parts of the eastern, southern, and western boundaries are conventional lines of which the best known is the "Mason and Dixon Line."

The *eastern* and *northern* boundaries of Maryland consist of the Atlantic Ocean and a line separating the former possessions of the Penns, now the states of Pennsylvania and Delaware, from those of the Lords Baltimore. From the original settlements of the country until 1760 when the courts interpreted the manner of carrying out the Agreement of 1732, these boundaries were in dispute. According to this agreement the boundary line was to run due west from "Cape Henlopen" (Fenwicks Island, fifteen miles south of the point now known as Cape Henlopen) to a point midway between the Chesapeake and the Atlantic. From this "middle point" the line was to run northerly tangent to a circle of twelve miles radius whose center was at Newcastle, Delaware. From the "tangent point," where the tangent line touched the circle, the boundary was to follow the circle to a point due north of the tangent point. From this point the line was to run due north to the northeast corner of the State, which was to be on the parallel of latitude, fifteen miles south of the southernmost part of Philadelphia as it was at the time of the legal decision in 1760. From this northeast corner the boundary was to extend due west to the western limits of the State.

The causes leading to such a complicated line are intimately related to the history of the early settlements in the three states affected. The original grants to Lord Baltimore in 1632 seem to include territory which was subsequently granted to William Penn and a smaller area settled by the Swedes and Dutch and subsequently granted to the Duke of York. The latter gave rise to the circular boundary about Newcastle, the former to the compromise lines suggested by the English Government in 1683 and subsequently settled by the Agreement of 1732. Attempts had been made by local surveyors to run the lines during the decade preceding the assignment of the work in 1763 to Charles Mason and Jeremiah Dixon, noted English astronomers and mathematicians, but the difficulties of running such peculiar lines through unbroken forests had been too great for the colonial surveyors with their crude instruments. When Messrs. Mason and Dixon arrived in Philadelphia, in 1763, they found that the local surveyors had already determined the "middle point" and the "tangent point" and had run a provisional line as far as the northeast corner of the State. From the time of their arrival in November 1763 until December 1767, Mason and Dixon were engaged in determining the various local points and in running and marking the northern boundary of the State, which they continued to Dunkard's Creek, some miles beyond the limits of Maryland, where they were stopped by the Indians. They also re-ran and marked the tangent line beginning at the "middle point." Along the greater portion of the lines surveyed by them each mile was marked by a stone monument (mounds of stone surrounding wooden posts were used west of Sideling Hill) which had on four out of five mile-stones the letter "P" engraved on the northern side, and the letter "M" on the southern side, while at each fifth mile was a stone of the same size, known as a "crown-stone," with the coat-of-arms of the Penns cut on the northern face and with that of Lord Baltimore on the southern. These stones came from the quarries on the Isle of Portland in England. Some of the original monuments remained in good condition but many had become dilapidated or had been removed when the legislatures of Maryland and Pennsylvania made provision in 1900 for the relocating and remarking of the line. The work was completed in 1904 by a Commission composed of representatives of the States of Maryland and Pennsylvania and of the United States Government. This line, known as the Mason and Dixon Line, became famous in the great controversy preceding the Civil War as the boundary between the free and slave-holding states and has been regarded as the division line between the North and South.

The *southern* boundary, long in dispute, was permanently settled in 1874, as far as the Maryland-Virginia portion is concerned, by a board of commissioners appointed by the states of Maryland and Virginia. According to this agreement the boundary follows the low-water line on the right bank of the Potomac River to Smith's Point at its mouth, thence northeasterly across Chesapeake Bay to the southern end of Smith's Island, and thence to the middle of Tangier Sound. Here the boundary runs south 10°30′ west, until it intersects a straight line connecting Smith's Point and Watkins' Point, and thence eastward through the center of Pocomoke Sound and Pocomoke River until it reaches the westward prolongation of the old Scarborough and Calvert line surveyed in 1668, which it follows to the Atlantic Ocean. There is still some controversy as to the exact location of some of the boundary marks, especially in Pocomoke Sound where the oyster interests of Maryland and Virginia conflict. The states of Maryland and West Virginia have not yet agreed on the western terminus of this line.

The *western* boundary of the State has not been finally settled. According to the original charter, this line was to run due north from the "first fountain" of the Potomac River. The North Branch was early regarded as the main stream but later surveys showed the South Branch to be longer than the North Branch. The "Fairfax Stone" supposed to be placed at the westernmost source of the North Branch, has been recently shown to be on a tributary of that stream. The real source is about one mile farther west, and this point has been recently marked by the State of Maryland with a monument known as the "Potomac Stone." A very crooked line run by Francis Deakins in 1787 from the Fairfax Stone is now claimed by West Virginia as the boundary line. Subsequently in 1860 a straight line was run by Lieut. N. Michler, U.S. A., from the same point. In 1897 W. McCulloh Brown and Dr. L. A. Bauer ran a straight line from the Potomac Stone. The questions at issue must be passed on by the Supreme Court of the United States.

Size.—The extreme width of the State from east to west is 240 miles, and the extreme length from north to south 125 miles, the latter, however, narrowing toward the west where it becomes less than two miles at Hancock. Beyond this point it again broadens, although narrowing again at Cumberland to five miles. The total area within the limits of the State is estimated at 12,210 square miles, of which 9,891 square miles are land. The remaining 2,319 square miles are water, distributed as follows: Chesapeake Bay, 1,203; Chincoteague Bay, 93; smaller estuaries and streams, 1,023 square miles.

Counties.—Maryland is divided into 23 counties and Baltimore City of which Garrett, Allegany, Washington, and the western part of Frederick comprise the mountainous region known as Western Maryland; the eastern part of Frederick, Carroll, Montgomery, Howard, Baltimore, Harford, and the western part of Cecil the Piedmont area, which is also referred to under the name of Northern-Central Maryland; Anne Arundel, Prince George's, Calvert, Charles, and St. Mary's, commonly called Southern Maryland; and the eastern part of Cecil, Kent, Queen Anne's, Talbot, Caroline, Dorchester, Wicomico, Somerset, and Worcester, known as Eastern Maryland. Of these twenty-three counties all but seven lie upon navigable waters.

There seems to have been no consistent method adopted in erecting the several counties of the State. Some, like St. Mary's and Kent, grew

THE POPULATION OF THE STATE BY COUNTIES.

Counties	Date of Erection	State Census 1901	United States Census			Area in sq. miles	County towns
			1900	1890	1880		
Allegany	1789	53,304	53,694	41,571	38,012	440.5	Cumberland
Anne Arundel	1650	34,791	39,620	34,094	28,226	430.4	Annapolis
Baltimore	1659	88,028	90,755	72,909	83,336	646.8	Towson
Baltimore City	1729 } 1851 }	517,035	508,957	434,439	382,313	30.0	....
Calvert	1654	9,963	10,223	9,860	10,538	216.8	Prince Frederick
Caroline	1726	16,792	16,248	13,903	13,766	317.4	Denton
Carroll	1838	33,651	33,860	32,376	30,992	445.3	Westminster
Cecil	1674	24,450	24,662	25,851	27,808	374.6	Elkton
Charles	1660	16,602	17,662	15,191	18,548	462.0	La Plata
Dorchester	1666	28,293	27,962	28,843	23,110	573.2	Cambridge
Frederick	1748	51,639	51,920	49,512	50,482	660.0	Frederick
Garrett	1872	17,386	17,701	14,213	12,175	681.0	Oakland
Harford	1773	28,307	28,269	28,993	28.042	439.8	Belair
Howard	1850	16,276	16,715	16,269	16,140	249.1	Ellicott City
Kent	1637	17,788	18,786	17,471	17,605	281.0	Chestertown
Montgomery	1776	29,155	30,451	27,185	24.759	517.6	Rockville
Prince George's	1695	28,325	29,898	26,080	26,451	479.6	Upper Marlboro
Queen Anne's	1706	18,568	18,364	18,461	19,257	363.4	Centerville
St. Mary's	1637	25,628	17,182	15,819	16,934	369.1	Leonardtown
Somerset	1668	16,890	25,923	24,155	21,668	328.6	Princess Anne
Talbot	1661	20,314	20,342	19,736	19,065	267.1	Easton
Washington	1776	44,491	45,133	39,782	38,561	457.3	Hagerstown
Wicomico	1867	22,908	22,852	19,930	18,016	368.9	Salisbury
Worcester	1742	20,805	20,865	19,747	19,539	491.5	Snow Hill
The State	....	1,181,691	1,188,044	1,042,390	934,943	9,891.0	Annapolis

with the development of the province and were subsequently bounded by the erection of new counties; others, like Charles and Dorchester, were erected by the ruling Lord Baltimore. Cecil County was erected by proclamation of the Governor while Washington, Montgomery, Howard, and Wicomico were established in constitutional conventions. The great majority of counties were, however, erected by Acts of Assembly. The records now extant do not show the original extent or the exact date of erection of several of the counties but it is of interest to note that eighteen out of the twenty-three counties were established before the close of the Revolutionary War and eleven of these before 1700. Baltimore City, since 1851 has not been in any county but unlike any other American city except Greater New York is a distinct division of the State.

TOTAL POPULATION AT VARIOUS PERIODS.

Year	1634	1660	1671	1701	1715	1748	1756	1760	1770
Population	200	12,000	20,000	25.000	30,000	130,000	154,188	166,523	199,827

Year	1775	1782	1790	1800	1810	1820	1830	1840
Population	225,000	254,050	319,728	341,548	380,546	407,350	447,040	470,019

Year	1850	1860	1870	1880	1890	1900
Population	538,034	687,049	780,894	934,943	1,042,390	1,188,044

The counties of Maryland, unlike those of many other states, are the ultimate units of territory and not the combination of townships. This fact together with the paucity of large towns and the agricultural character of the communities have made the counties as such of unusual importance in all political and social relations. Election districts are established in all the counties.

HISTORY.—Maryland was settled by a party of Englishmen under Leonard Calvert, who left the mother country in the "Ark and Dove" in 1633, and finally landed near the mouth of the Potomac, on the shores of St. Mary's River, in 1634. The proprietor, Cecilius Calvert, second Baron of Baltimore, received the territory from Charles I, under a charter which allowed many liberties, including freedom from taxation by the King. In 1649 the colonists established these privileges by the "Toleration Act" which forbade discrimination on account of religious opinions. The Puritans from Virginia sought refuge in Maryland, and in 1652 even captured the State government for a period.

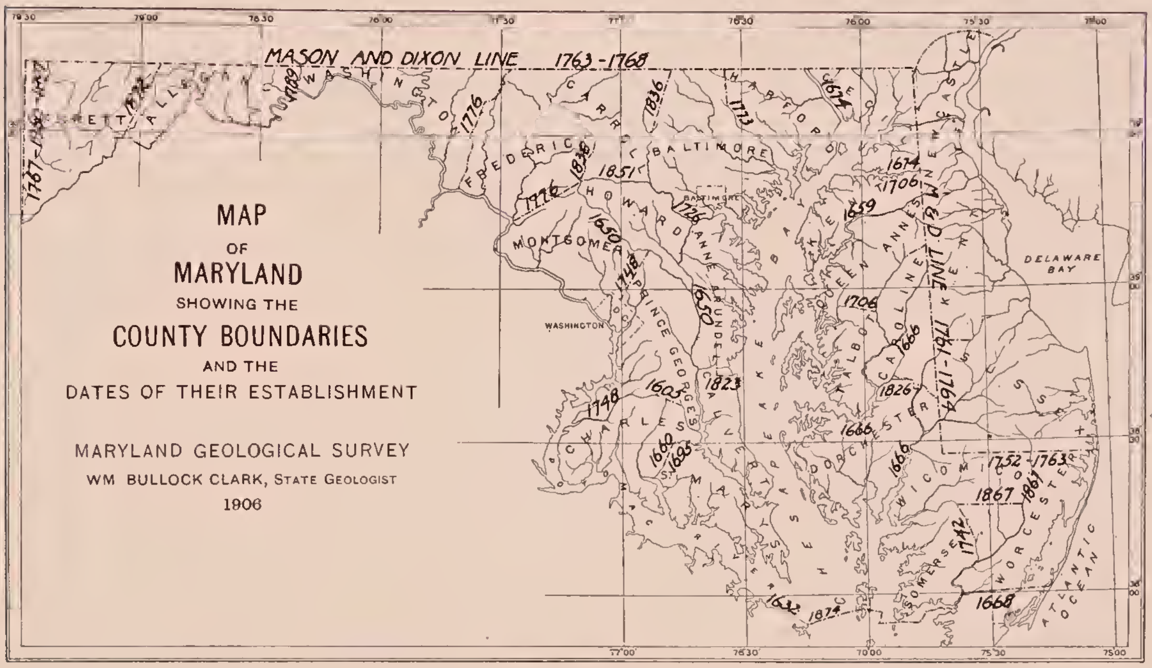


Fig. 1.—Map of Maryland showing Boundaries.

About this time the Duke of York (afterwards James II), through ignorance of the country, deeded to William Penn some of the land which had already been given to Lord Baltimore. This mistake led to a long border dispute which only ended with the location of the Mason and Dixon Line (1763-1767). In 1694 the capital of the State was moved from St. Mary's City to Annapolis.

During the Revolutionary War no important military operations took place in Maryland, although the "Maryland Line" fought with valor in many engagements, especially those of Long Island, Camden, Cowpens, Guilford, and Eutaw Springs. On December 22, 1783, Washington resigned his commission as commander-in-chief of the army in the Senate chamber at Annapolis where the Continental Congress was then in session.

During the War of 1812 several Maryland towns were pillaged by the British, but Baltimore was saved from plunder by the repulse of the enemy at North Point and Fort McHenry. It was during the bombardment of the latter place that Francis Scott Key wrote "The Star-spangled Banner."

Among the battles of the Civil War three were fought on Maryland soil, South Mountain (September 14, 1862), Sharpsburg, or Antietam (September 16-17, 1862), and Monocacy (July 9, 1864). There were also small conflicts at many points, especially along the Potomac.

In the history of the State are many incidents which have since become of national or international importance. The first wheat was shipped to Europe from Baltimore in 1771; the first regular steam-packet that crossed the Atlantic direct from the United States sailed from Baltimore in May, 1838; while the Morse telegraph line transmitted its first message ("What hath God wrought") from Baltimore to Washington, April 9, 1844. Baltimore was the first city in America to have a water company (1792), street gaslights, a railroad (1828), and an electric street railroad (1881). The city contains the first American monument to Columbus, the first official state monument to George Washington, the oldest American lodge of the Independent Order of Odd Fellows, and the oldest College of Dental Surgery.

The earliest settlers in Maryland were Englishmen, whose descendents are now scattered all over the State, and comprise the leading element in the population. Many of the early settlers in the country adjacent to Pennsylvania were of German extraction, and their descendents are to-day numerous and influential. Next in importance are the negroes who comprise one-fifth of the population and who are relatively more prominent in Charles, Calvert, and St. Mary's counties, where they compose fully one-half of the population; and least important in the western counties along the Mason and Dixon Line, where there is only one negro, on the average, to fourteen whites. In Baltimore, Cecil, and Harford counties, the negroes comprise one-sixth of the population, while in the counties of the eastern and western shore, not previously enumerated, they form about two-fifths of the entire population. During the last twenty-five years there has been a great increase in the Polish, Hungarian, and Bohemian inhabitants, who have settled chiefly in Baltimore City.

Maryland has always been a religious center. As early as 1629 services were regularly conducted on Kent Island by an ordained minister

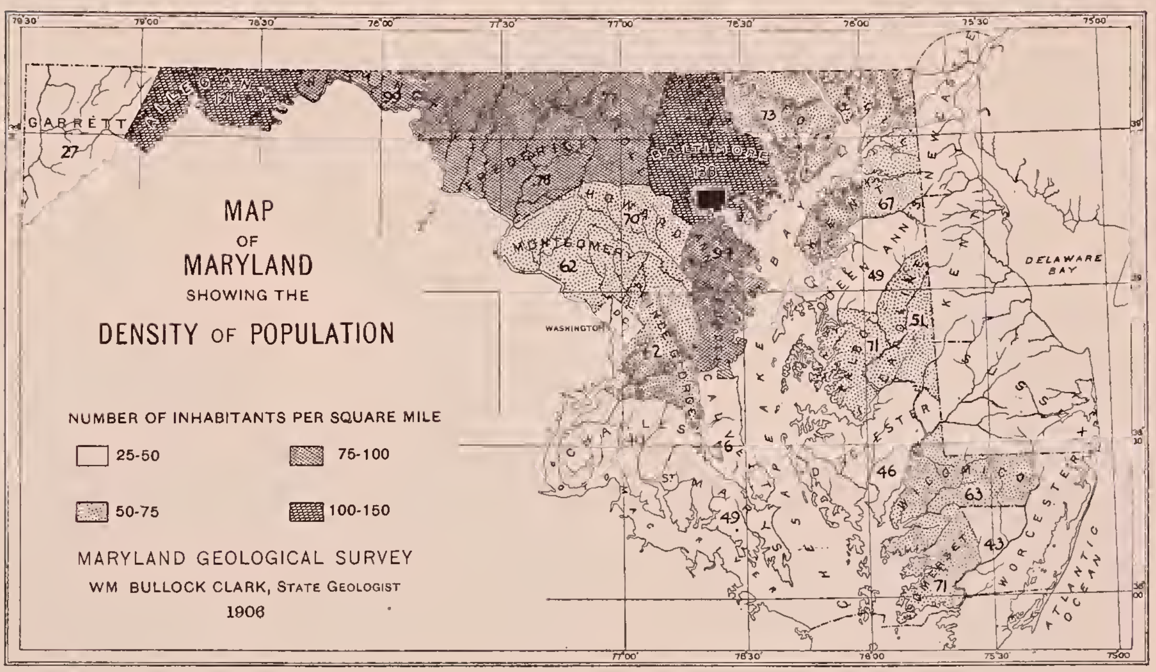


FIG. 2.—Map of Maryland showing the Density of Population by Counties.

of the Church of England. The first Presbyterian Church in America was established at Snow Hill about 1700, and in 1766 Robert Strawbridge established the first Methodist congregation in America in Carroll, then Frederick County. Many of the most prominent of the early settlers were Roman Catholics, and the See of Baltimore has held the first position in America since the decree of 1858. There are 59 denominations or sects represented in Maryland, and although many of them are scattered throughout the State they show local variations in strength, which are often closely related to the history, beliefs, and nationalities of the early settlers.

State Government.—The present government of the State of Maryland is based on a Constitution formulated and ratified in 1867. Earlier constitutions were adopted in 1776, 1851, 1864, and the constitution of 1776 was very much changed in 1837. According to the present Constitution the State is divided into 23 counties and Baltimore City, which in turn are subdivided into districts for school and election purposes. There are no units such as townships, but the local affairs of the cities, towns, and villages are carried on by officers in accordance with charters and special acts.

Among the State officials under the Constitution of 1867 are the Governor, elected for four years, and the Secretary of State, who is appointed by the Governor. The Senate and House of Delegates, which together form the General Assembly or Legislature, consist of 27 Senators elected for four years, one from each of the 23 counties and the four districts of Baltimore City, and 101 Delegates, elected for two years. Each of the legislative districts of Baltimore is entitled to six Delegates, the number allowed the largest county. The Assembly meets every other year, on the first Wednesday in January, and may remain in session only 90 days. At the call of the Governor a special session may be held, which is limited by law to 30 days.

The judicial powers of the State are vested in a Court of Appeals composed of eight judges; Circuit Court with eight chief judges, seven of whom are the judges of the Court of Appeals, and twenty-two associate judges, eight of the latter with one chief judge, who is not a member of the Court of Appeals, constituting the Supreme Bench of Baltimore City; and Orphans' Court with seventy-two judges. The Appeal and Circuit Court judges are elected for fifteen years, the judges of the Orphans' Court for four, the registrars of wills for six, and the sheriffs for two. The Attorney-General of the State and the State's Attorneys are elected for four years. Justices of the peace, constables, coroners, and notaries are appointed by the Governor.

Among other prominent State officials are the Comptroller, who is the financier for the State, and who is elected by the people for two

VIEW OF THE STATE HOUSE AT ANNAPOLIS.

years; and the Treasurer, who is the banker and who is elected by the General Assembly for a two-year term.

The more important State organizations are the Board of Public Works, Militia, Fishery Force, Land Office, State Agricultural Experiment Station, State Geological Survey with its Highway Division, State Weather Service, State Horticultural Bureau, Bureau of Industrial Statistics, Immigration Bureau, Board of Education, Board of Health, Boards of Medical Examiners, Examiners of Dental Surgery, State Lunacy Commission, Live Stock Sanitary Board, and the Fish Commission.

EDUCATION.—The educational history of the State dates back to 1696, when Governor Francis Nicholson established the first public school at Annapolis, now St. John's College. The State schools were brought under the general supervision of the State Board of Education in 1864, and are now supported by State and local taxation. A State Superintendent of Schools was provided for by the General Assembly of 1900. The State schools also include a Normal School for teachers, schools for the deaf and dumb, and for the blind. Baltimore is the educational center of the State. In this city are located the Johns Hopkins University and Medical School, Maryland University, Peabody Institute, The Woman's College of Baltimore, Maryland Institute, St. Mary's Seminary, College of Physicians and Surgeons, Baltimore Medical College, Maryland College of Pharmacy, Baltimore College of Dental Surgery, and many others.

Within the limits of the State are also the Maryland Agricultural College at College Park, St. John's College at Annapolis, Washington College at Chestertown, Mt. St. Mary's College at Emmitsburg, Western Maryland College at Westminster, and many smaller institutions.

HISTORY OF INVESTIGATIONS REGARDING THE PHYSICAL FEATURES OF THE STATE.

The study of the physical features of Maryland began at a very early period and has continued almost uninterruptedly to the present day. The resources of the State early attracted attention and there was no colony more conspicuous than Maryland for its varied natural wealth and the unparalleled transportation facilities afforded by the Chesapeake Bay and its numerous estuaries.

Early Investigations.—The first account of the physical characteristics of the Maryland area is given by Captain John Smith in "The General Historie of Virginia" as the result of explorations which he made of the Chesapeake Bay and its tributaries in the year 1608. The shores of the Bay were surveyed by him as far as the Susquehanna River and the Potomac River was ascended to the falls above Georgetown. The map which Captain Smith prepared shows with remarkable correctness the outlines of the regions which he visited and was the basis of most cartographic work for the next two centuries.

An important publication entitled "A Relation of Maryland" was published in 1635 in which a description is given of the agricultural soils and the minerals observed by the first settlers. From this it is evident that bricks were made from the very settlement of the province out of the clays of the region and that the iron ore which later afforded the basis for one of the most important industries of colonial times was already observed. The marl also was used to enrich the soil and certain of the better clays were employed in the making of simple pottery.

In 1670 Augustin Herman, a Bohemian engineer, published his map of Maryland which had been prepared at the request of Lord Baltimore, and in return for which he obtained Bohemia Manor on the Eastern Shore. The map represents many portions of the country unvisited by Smith, although in many particulars it marks no advance over that of the latter.

With the increase in the number of colonists and the gradual settlement of the country, wider knowledge was gained regarding the physical features of Maryland; new industries were opened up and the older ones still further extended so that before the close of the seventeenth century Maryland became one of the most progressive of the colonies in the development of her natural resources.

During the eighteenth century the natural resources of Maryland were still further explored and many important industries established, Maryland ranking among the foremost of the colonies in the production both of iron and copper. The Assembly in 1719 passed an Act for the encouragement of the iron industry in which it is stated "that there are very great conveniences for carrying on of iron works within this province, which have not hitherto been embraced for want of proper encouragement to some first class undertakers."

One of the most important factors in the development of the iron industry was the organization in 1722 of the Principio Company, which in that year commenced the erection of a furnace in Cecil County near the mouth of Principio Creek. This company was composed of English gentlemen of wealth who were familiar with iron manufacture in the old country. At an early date in the history of this enterprise, probably 1725, Augustine and Lawrence Washington, the father and half-brother of the future President of the United States, became interested in the company, which soon outranked all others in America in the manufacture of pig and bar iron, being the proprietor of three furnaces and two forges in Maryland and one furnace in Virginia.

Many other companies were organized for the working of the iron deposits prior to the Revolution. A Baltimore company, which was incorporated in 1723, built a furnace at the mouth of Gwynn's Falls. A blast furnace in Harford County was built about 1760. In 1761 the Governor and Council of Maryland reported to the Commissioners of the Board of Trade and Plantations in England that there were eighteen furnaces and ten forges in the State, which made 2,500 tons of pig iron per year.

Just prior to the beginning of the Revolution several furnaces were built in central Maryland, among them being the Catoctin furnace in Frederick County. Bishop says that during the Revolutionary War there were seventeen or eighteen forges in operation in Maryland in addition to the furnaces and other iron works. These furnaces and forges were built mostly on the tributaries of Chesapeake Bay. They were all of the same type, using charcoal for fuel with cold blast and applying the power of the blow-cylinder by water-wheels. Some of these furnaces, especially the Catoctin furnace, furnished guns and projectiles for the Continental army.

During these years attempts were also made to discover and develop other mineral products. In a letter from Philemon Lloyd to Lord Baltimore and co-partners in 1722 the writer speaks of the discovery of copper ore and other minerals. A report made by the Governor and Council to the Board of Trade of London in 1748 states among other things that "there are in the Province great shews of copper in many places, but of the several attempts that have been made to discover veins of that metal none has yet been made that quitted cost." It was probably shortly after this that a party of English miners opened the Liberty and Mineral Hill mines. They built a small smelting furnace on the Deer Park tract of land near the latter mine where they smelted the ores, and must have produced considerable quantities of copper, as shown by the large amount of rich slags and residue left at the furnace, which nearly a century later were hauled to Baltimore and profitably reworked. Operations at these mines ceased for a time with the opening of the Revolution.

In various letters to Lord Baltimore during the period above described, references are made to the natural resources of the State and accounts are given of the different types of rock, of the condition of the soils, and of the general character of the country, based particularly on more extended explorations of the central and western portions of the colony. Before the opening of the Revolution there was already a wide acquaintance with the broader features of the physiography and mineral products of Maryland.

The controversy regarding the northern boundary of the State which was finally determined by the survey of Mason and Dixon, already described, also added much to the existing knowledge regarding the physical features of the State.

The years following the Revolutionary War witnessed the gradual development of the modern science of geology. At first the methods were crude, but already some years before the organization of the first survey of the State, geology had come to take a leading position among the sciences. It was only during the last decade of this period that anything like modern methods of classification and of cartographic representation of geological formations came to be generally adopted, yet during these years much was done in the elucidation of the geology of Maryland. The first observations on the geology of Maryland during this early period were made by Thomas Jefferson and published in his "Notes on Virginia" in 1782.

A contribution of much importance was made by Wm. Maclure of Philadelphia in 1809 to the American Philosophical Society entitled, "Observations on the Geology of the United States explanatory of a geological map," in which we have the first attempt at a correlation of American formations with those of Europe, the Wernerian classification being adopted.

In 1810 Dr. H. H. Hayden presented a "Mineralogical and Geological Description of the Country Surrounding Baltimore," in which an area extending about nine miles from the city and including the region of the Bare Hills, is considered; and in 1814 Robert Gilmor, Jr., published "A Descriptive Catalogue of Minerals occurring in the vicinity of Baltimore, arranged according to the distribution méthodique of Hauy," in which he enumerates forty-three minerals found within a distance of 12 miles of the city.

Dr. Hayden published in Baltimore in 1820 a most interesting volume, entitled "Geological Essays; or an Inquiry into some of the Geological Phenomena to be found in various parts of America and elsewhere," in which numerous Maryland localities are cited, especially in the vicinity of Baltimore, in support of the theories which he advanced. Among other interesting facts he mentions the finding of mastodon teeth in Maryland.

An important contribution to the stratigraphy of the Coastal Plain formations of Maryland was made by Professor John Finch in a "Geological Essay on the Tertiary Formations in America," in the American Journal of Science and Arts for 1824. This was the first attempt at a correlation of the deposits of the Coastal Plain on scientific grounds, and although thus early in the history of the subject minute comparisons, which were not justified by the facts, were made, yet the knowledge of the Maryland Tertiary formations was materially advanced. In this article Professor Finch objects to Maclure's use of the term "alluvium" and shows that the formations so called are "contemporaneous with the newer Secondary and Tertiary formations" of other parts of the world.

During the same year Thomas Say of Philadelphia presented "An Account of some of the Fossil Shells of Maryland," in which he describes and figures many new species, although he draws few geological inferences from the organic remains examined.

Another contribution of some moment is "An Account of the Examination and Surveys, with Remarks and Documents Relative to the Projected Chesapeake and Ohio, and Lake Erie Canals," which was published by James Shriver in Baltimore in 1824. This pamphlet includes remarks on the minerals and rocks of the area traversed.

In Robinson's "Catalogue of American Minerals, with their localities," published in Boston in 1825, several pages are devoted to Maryland minerals.

The publication of an article by Dr. T. A. Conrad of Philadelphia "On the Geology and Organic Remains of a part of the Peninsula of Maryland" in 1830 marks the beginning of a new epoch in the study of Maryland geology. Unlike his predecessors, Conrad from the first applied the paleontological evidence he possessed to an interpretation of the stratigraphy; and although many of his conclusions were erroneous, still the knowledge of the geology of the Coastal Plain was very materially advanced by the methods which he introduced. During this and subsequent years Conrad added largely to the knowledge of the Tertiary faunas of Maryland and Virginia.

During the same year Philip T. Tyson published his "Notice of some

Localities of Minerals in the counties of Baltimore and Harford, Md.," in the American Journal of Science and Arts. Maryland is indebted to many important contributions from his pen from this time forward.

The close of the period prior to the organizations of the First Geological Survey of Maryland found much interest developed in the study of the geology of the State and at this early day considerable knowledge had been gained regarding the geological deposits.

FIRST STATE GEOLOGICAL SURVEY, 1833-42.—The General Assembly of Maryland in 1833 passed resolutions authorizing the Governor and Council to appoint an Engineer and a Geologist, the former to report on "a plan and drawing for a complete map of Maryland," etc., and the latter on the "probable cost of a Geological Survey of the State." In connection therewith they were authorized to collect all available information and make such researches as were necessary to that end. J. H. Alexander was appointed Engineer and J. T. Ducatel, Geologist.

In 1834 "An Act to provide for making a new and complete Map and Geological Survey of this State" was passed by the General Assembly and the same men were continued as Engineer and Geologist respectively. Although the work on the State map was greatly interfered with by legislation requiring special surveys, Alexander completed about 1840 a topographical map of the State on the scale of 1 : 200,000 with 50-foot contour lines to the east of the Monocacy River and 100-foot contour lines to the west of that stream. Several special topographical maps had been completed prior to this time, among them one of Dorchester, Somerset, and Worcester counties on the scale of 1 : 211,200 with 4-foot contour lines in 1835 and published in the report of the Geologist for that year; and another of St. Mary's, Charles, and part of Prince George's counties on the scale of 1 : 200,000 with 10-foot contour lines, which was likewise employed by the Geologist in the same publication as a base for his geological data. The topographic work has peculiar interest to-day since it represents the first attempt of any State to carry on a topographic survey.

The geological investigations were extended over the greater portion of the State and small annual reports were issued by Ducatel until 1841, the offices of Engineer and Geologist being abolished in February, 1842. The last report of the Geologist dealt with the important resources of the western section of the State, then just coming to be recognized for the first time. In addition to the work of the State Geologist, before described, a pamphlet was prepared in 1836 by James C. Booth upon the coal lands of a portion of the Georges Creek basin, and in the succeeding year further contributions were made by Philip T. Tyson and D. V. Douglas. Tyson also prepared at this time "A Descriptive Catalogue of the principal minerals of the State of Maryland," which was published in the Transactions of the Maryland Academy of Science and Literature.

During the latter years of the existence of the State Survey, Dr. Conrad made further contributions to the Tertiary geology and paleontology of Maryland, describing numerous fossils from the Calvert Cliffs. Correlations were also made of the Eocene deposits of Upper Marlboro, Fort Washington, and other localities.

After the organization of the Maryland Geological Survey the neighboring states of Virginia, Pennsylvania, and Delaware followed the same course, the survey of Virginia being organized in 1835 under W. B. Rogers, that of Pennsylvania in 1836 under H. D. Rogers, and that of Delaware in 1839 under J. C. Booth. The investigations carried on by these surveys along the borders of Maryland were of much importance in deciphering the geological structure of the formations of Maryland as well. The work of the Rogers brothers particularly to the north and south of Maryland had an important bearing upon the development of knowledge regarding the geology of the State of Maryland and the results of their work are still frequently employed by those seeking information regarding the geological structure of the State.

Investigations to Outbreak of Civil War.—After the termination of the Geological Survey little was done in the study of the geology of the State for several years. Dr. Conrad continued his study of the Maryland and Virginia Tertiary faunas. This period was also marked by a visit of Sir Charles Lyell, the eminent English geologist, to the Carboniferous area of Western Maryland, an account of which is given in his volume of travels in America published in 1845. About this time

Professor James Hall of Albany, New York, secured large collections of Silurian and Devonian fossils from the Cumberland region, many of which were figured and described in the first volume of the Paleontology of New York, published in 1847.

Important work was going on during this period in the neighboring State of Pennsylvania under H. D. Rogers the State Geologist, which was of much value in determining the classification and distribution of the geological formations of central and western Maryland. The final report of this Survey appeared in 1858 and it is still an important source of information. The Survey of Virginia under W. B. Rogers had a much shorter existence and had already terminated before the abolition of the Maryland organization.

The U. S. Coast and Geodetic Survey began its surveys in Maryland in 1844 in the vicinity of Baltimore and from that time down to the present day has with some intermissions been almost continuously engaged in work in Maryland territory.

In 1848 the State made provisions for a State Agricultural Chemist, the first incumbent of the office being Dr. James Higgins. His work possessed little of geological interest, but he was succeeded in 1858 by Mr. Philip T. Tyson, who devoted a large part of his time to geological investigations, believing as he stated in his First Report published in 1860, that "from what is now known of the origin and character of soils, we must conclude that the very foundation of any intelligent and practical application of science to agriculture in any region, must consist of a thorough investigation of its geological and mineral constitution." In this same report Tyson published the first colored geological map of the State on the scale of 12 miles to an inch, that was by far the most complete representation of Maryland's geology that had been attempted up to that time. A second report was published in 1862 in which further attention is given to the mineral resources of the State. In this latter year the office of State Agricultural Chemist was abolished.

INVESTIGATION SUBSEQUENT TO CIVIL WAR UNTIL 1880.—The Maryland Academy of Sciences was established in 1863 with Mr. Philip T. Tyson as its first president. Much interest continued to be shown by him in the geology of the State which has been maintained by his co-worker and successor, Dr. Philip R. Uhler, who in later years frequently contributed articles regarding the mineral characteristics of the area.

The Maryland Agricultural College and Experiment Station, the former established in 1856, and greatly strengthened by Federal action in 1862 and subsequently, have in the years since the Civil War taken an active and important part in the study of the agricultural possibilities of the State.

Among the more important private contributions to the knowledge of the geology of the State during this period were those made by Dr. Conrad and his colleagues of the Philadelphia Academy of Sciences who continued their studies of the younger formations of the State, and Dr. James Hall of Albany who continued his elaborate studies of the Paleozoic fossils of the Appalachian region and who published in the Reports of the New York Geological Survey numerous figures and descriptions of Western Maryland forms.

In 1876 the U. S. Coast and Geodetic Survey made a survey of Baltimore harbor and its approaches, the General Assembly having appropriated $5000 for the purpose. In 1886-87 the earlier work was supplemented by a verification of the triangulation and its adjustment to more recent computations. Work in other sections of the State was also in progress during this period which resulted in published charts that have added much to our knowledge of the topography and hydrography of the lands and waters of the Chesapeake Bay region and its larger tributaries.

Investigations from 1880 to organization of present State Geological Survey.—The organization of the Johns Hopkins University in 1876 inaugurated a new period of scientific activity in Maryland that has meant much for the material advancement of the State. The authorities from the start recognized the importance of a thorough study of the physical characteristics of the region adjacent to Baltimore as well as of the State. The organization of the Chesapeake Zoological Laboratory in the summer of 1878 under the immediate charge of Dr. W. K. Brooks marked the beginning of systematic work in this direction. A close association with the Maryland Fish Commission was effected and in 1879 the laboratory was stationed at Crisfield where an excellent opportunity was afforded for the special study of the oyster beds of the Chesapeake. The results of this work were subsequently published as a report of the Maryland Fish Commission in a volume entitled "The Development of the American Oyster."

In 1880 the Baltimore Naturalist's Field Club was organized under the direction of Professor H. N. Martin of the University for the study of the fauna, flora, geology, and physical geography of the neighborhood of Baltimore. The club was founded "in order to meet the recognized want in the city of some organization for the active promotion of field work in natural history." All members of the University and residents of Baltimore of known attainments as naturalists were eligible for election to the club. An outcome of the work of the field club was the preparation in 1884 of an excursion map of Baltimore and its neighborhood by Mr. A. L. Webster, a student of the University who had formerly been a topographer of the United State Geological Survey.

The Geological Department was organized in 1883 when Dr. George H. Williams began his connection with the institution as an instructor in mineralogy. His appointment marks the beginning of a period of investigation of the geology and mineral resources of the State that has been carried on by his associates and successors continuously to the present day. It is certainly not claiming too much to say that this period is by far the most important in the study of the physical features of Maryland.

Almost from the first the members of the geological department have carried on their investigations in close co-operation with the United States Geological Survey and frequently as members of its staff. The results obtained have received wide publicity, and have greatly benefited the State.

The investigations of Dr. Williams were largely devoted to the crystalline rocks of the Piedmont Plateau lying to the north and west of Baltimore, which through his labors has become classic ground in microscopical petrography. Many articles were published by Dr.

Williams on the geology of the State from 1883 until his death in 1894.

In 1887 Dr. W. B. Clark became associated with the University as instructor of stratigraphic geology and paleontology and at once took up a study of the geological formations of the Coastal Plain district in the eastern and southern counties of the State.

The preparation of a book upon Maryland which should properly set forth its resources, industries, and institutions was intrusted in 1892 by the Board of World's Fair Commissioners to members of the faculty of the Johns Hopkins University; those portions relating to the physical features and mineral resources being prepared by Professor Williams and Professor Clark. This summary of the physiography, geology, and mineral wealth of the State was the most complete statement which had been prepared up to that time. The full volume appeared in 1893, although special portions had been published from time to time by the authors in scientific journals.

Dr. Edward B. Mathews who had been appointed instructor in mineralogy and petrography in 1894 took up the work of Professor Williams in the Piedmont Plateau, devoting his attention especially to the northern counties of the belt.

Since the year 1896 the investigations of the instructors and students of the Johns Hopkins University have been so closely identified with the work of the Maryland Geological Survey that it is not necessary to describe the researches in detail since most of the results have been published in the volumes of the Survey.

The United States Geological Survey which was organized in 1879 initiated work in Maryland in 1883. Attention was chiefly directed at the start to the preparation of a topographic map of the region as part of a plan for a map of the United States. A good deal of preliminary work was done from time to time during the next thirteen years until the organization of the Maryland Geological Survey when a systematic joint survey of the State was inaugurated, nearly all of the old maps having been since that time resurveyed.

Geological work was also carried on by the United States Geological

Survey in various portions of the State chiefly in co-operation with the instructors of the Johns Hopkins University. A number of the members of the National Survey were also engaged in the study of various problems within the State including Messrs. W. J. McGee and N. H. Darton in the Coastal Plain and Mr. Arthur Keith in the Catoctin and Blue Ridge district.

Hydrographic work was commenced by the United States Geological Survey in Maryland in 1891 by a study of the Potomac River. This work was still further extended in 1896 by the establishment of stations on other streams in co-operation with the Maryland State Weather Service. Since the publication of the first annual tabulation of the mineral resources of the United States in 1883, the United States Geological Survey has each year given an account of the Maryland output, its information in later years being largely based on the work of the Maryland Geological Survey which has yearly collected the statistics.

The U. S. Weather Bureau has also done much for many years in the study of the climate of the State, its Baltimore office being the headquarters of a Section Director who, in co-operation with the Maryland State Weather Service which was organized in 1892, has systematically by the means of local observers throughout the State secured daily observations regarding the temperature and rainfall as well as frequent reports regarding the condition of the crops. This information has been published at frequent intervals by the joint services, the State Bureau also issuing an elaborate monograph on the climate of the State in 1899.

INVESTIGATIONS OF PRESENT STATE GEOLOGICAL SURVEY, 1896 TO DATE.—The Maryland Geological Survey was inaugurated in 1896 by the passage of an act by the General Assembly entitled "An Act to establish a State Geological and Economic Survey, and to make provision for the preparation and publication of reports and maps to illustrate the natural resources of the State, together with the necessary investigations preparatory thereto." In 1898 and again in 1904 further acts were passed adding to the scope of the work as originally contemplated. The investigations now cover a wide variety of subjects including topography, geology, agricultural soils, climate, hydrography, terrestrial magnetism and forestry, as well as highway engineering. Reports covering all these subjects are issued from time to time as desirable material is collected. Ten volumes and many maps have already been published.

The topographic surveying which is carried on in co-operation with the United States Geological Survey, each organization contributing an equal amount to the support of the work, has now been completed for Garrett, Allegany, Baltimore, Harford, Prince George's, Calvert, St. Mary's, Cecil, Kent, Queen Anne's, Caroline, Talbot, Dorchester, Wicomico, Somerset, and Worcester counties, while portions of the remaining counties have also been surveyed. Nearly all of this work has been done since the organization of the State Survey as the earlier maps of the United States Geological Survey have in nearly every case either been fully revised or resurveyed. Many of the old maps were on too small a scale to meet the many demands made on them and the work at best was only considered of a preliminary character.

The geological work is now completed for somewhat over one-half of the State and follows as fast as possible the preparation of the topographic base maps on which the results are platted. A number of economic reports have been published including those on the building and decorative stones, the clays, and the coals, the three leading mineral products of the State. Systematic reports are complete for the Devonian, Eocene, Miocene, Pliocene, and Pleistocene, those for the Eocene and Miocene having already been published.

The highway work which was authorized by the General Assembly in 1898 was at first in the nature of an investigation of the highway needs of the State. The existing conditions were fully investigated, the amount of traffic studied, and plans prepared to meet the present requirements for a modern system of roads. The available materials throughout the State were carefully studied with a view to their use in road construction. At the request of the county authorities, surveys for intended improvements were made and plans and specifications furnished to many of the counties. The authorities came gradually to depend largely on the advice and help of the Survey's engineers. This work continued for six years, three biennial reports being issued during the period, until 1904 when a State Aid Highway Act was passed adding still further to the powers of the Geological Survey. Under this act $200,000 annually were appropriated by the State to meet one-half the expense of the roads built under the plans and specifications of the Highway Division of the Survey. Eighteen out of the 23 counties of the State applied the first year, the law becoming operative January 1, 1905, for aid under the act, and of these 14 went forward with the actual construction of the highways. By the terms of the act roads of a permanent nature must be built and the materials selected have been either crushed stone, gravel, or oyster shells, as the local conditions required.

The preparation of agricultural-soil maps has gone forward year by year in co-operation with the Bureau of Soils of the United States Department of Agriculture and maps have been completed for nearly one-half of the State. Measurements of the various streams have also been made by co-operation with the Hydrographic Division of the United States Geological Survey, permanent gages being maintained on all the leading water courses. Forestry studies have also been taken up in co-operation with the United States Forest Service and forestry maps have been completed for nearly one-half the State and will ultimately form the basis for progressive and intelligent forestry development. The magnetic declination has been studied for all sections of the State and north and south lines have been established at all of the county seats for the aid of the surveyors of each district. Tables of magnetic variation have been furnished the county authorities so that the metes and bounds of all land surveys can be readily verified where monuments are still extant.

An important service has been rendered by the State Geological Survey in the preparation of mineral exhibits for the Buffalo, Charleston, and St. Louis Expositions at all of which the State has received the highest praise and frequently greater recognition in this department than any other State in the country. At Buffalo the only Gold Medal awarded to any State for its exhibits of mineral resources was obtained by Maryland; at Charleston, where a larger number of medals were awarded, Maryland obtained twice the number of Gold Medals received by any other State in this department; and at St. Louis a Grand Prize and many Gold Medals were received for the elaborate display made by this department of the State government.

In 1900 the Governor of the State appointed the State Geologist a Commissioner on behalf of the State of Maryland to take charge of the resurvey of the Mason and Dixon line. An engineer of the United States Coast and Geodetic Survey was placed in charge of the field party and this work has now been completed and will add materially to the knowledge of the topography and other physical characteristics of the area adjacent to the northern boundary of the State.

PHYSIOGRAPHY.

The State of Maryland forms a portion of the Atlantic slope which stretches from the crest of the Alleghanies to the sea, and which is divided into three more or less sharply defined regions known as the Coastal Plain, the Piedmont Plateau, and the Appalachian Region. These three districts follow the Atlantic border of the United States in three belts of varying width from New England southward to the Gulf. Maryland is, therefore, closely related in its physiographic features to the states which lie to the north and south of it, while its central location on the Atlantic border renders the Maryland section perhaps the most characteristic in this broad tract. In crossing the three districts from the ocean border the country rises at first gradually and then more rapidly until it culminates in the highlands of the western portion of the State. The particular characteristics of each district will be fully discussed in the following pages.

The physical features of a country to no inconsiderable degree determine the pursuits of its inhabitants, and these indirectly affect their social, political, and financial welfare. The residents of mountainous districts have their peculiar occupations, while those of the low lands find their employment in other ways. In regions bordering the sea or inland bodies of water still other means of livelihood are sought by the people. The character of the soil and its adaptability to particular crops become also important factors, while the underlying rocks, not only by their influence upon the conditions of life already described, but also by their inherent wealth in mineral resources, still further influence the well-being of the community. It becomes necessary, therefore, to know something of the physical features of a country, or a State, if one would understand its past history or indicate the lines of its future prosperity.

Coastal Plain.

The Coastal Plain is the name applied to the low and partially submerged surface of varying width extending from Cape Cod southward through Florida and confined between the Piedmont Plateau on the west and the margin of the continental shelf on the east. The line of demarkation between the Coastal Plain and the Piedmont Plateau is sinuous and ill-defined for the one passes over into the other oftentimes with insensible topographic gradations, although the origin of the two

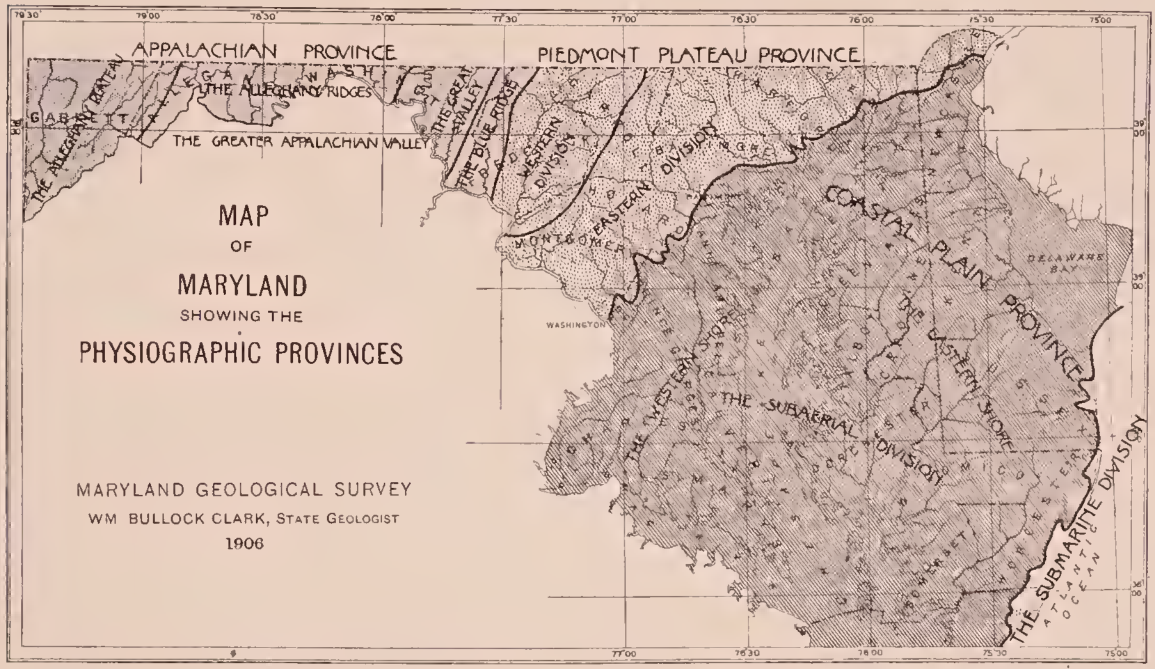


Fig. 3.—Map of Maryland showing the Physiographic Provinces.

districts is quite different. A convenient, although somewhat arbitrary, boundary between the two regions is furnished in Maryland by the Baltimore and Ohio Railroad in its extension from Wilmington southwestward through Baltimore to Washington. The eastern limit of the Coastal Plain is at the edge of the continental shelf. In the vicinity of Maryland this is located about 100 miles off shore at a depth of 100 fathoms beneath the surface of the Atlantic Ocean. It is in reality the submerged border of the North American continent which extends seaward with a gently-sloping surface to the 100 fathom line. At this point there is a rapid descent to a depth of 3000 fathoms where the continental rise gives place to the oceanic abyss.

THE DIVISIONS OF THE COASTAL PLAIN.

The Coastal Plain, therefore, falls naturally into two divisions, a submerged or *submarine division* and an emerged or *subaerial division.* The seashore is the boundary line which separates them. This line of demarkation, although apparently fixed, is in reality very changeable, for during the geologic ages which are past it has migrated back and forth across the Coastal Plain, at one time occupying a position well over on the Piedmont Plateau, and at another far out to sea. At the present time there is reason to believe that the sea is encroaching on the land by the slow subsidence of the latter, but a few generations of men is too short a period in which to measure this change.

The subaerial division is itself separable in Maryland into the Eastern Shore and the Western Shore. These terms, although first introduced to designate the land masses on either side of Chesapeake Bay, are in reality expressive of a fundamental contrast in the topography of the Coastal Plain. This difference gives rise to an Eastern Shore and a Western Shore type of topography. Chesapeake Bay and Elk River separate the two. But fragments of the Eastern Shore type are found along the margin of the Western Shore at intervals as far south as Herring Bay, and again from Point Lookout northwestward along the margin of the Potomac River. On the other hand an outlier of the Western Shore type of topography is found at Grays Hill in Cecil County at the northern margin of the Eastern Shore. The Eastern Shore type of topography consists of flat, low, and almost featureless plains, while the Western Shore is a rolling upland, attaining four times the elevation of the former and resembling the topography of the Piedmont Plateau much more than that of the typical Eastern Shore. It will be seen later that these two topographic types, which at once strike the eye of the physiographer as being distinctive features, are in reality not as simple as they first appear, but are built up of a complex system of terraces dissected by drainage lines.

The Coastal Plain of Maryland, with which most of the State of Delaware is naturally included, is separated from that of New Jersey by the Delaware River and Delaware Bay and from that of Virginia by the Potomac River, but these drainage ways afford no barriers to the Coastal Plain topography, for the same types with their systems of terraces exist as well in New Jersey and Virginia as in Maryland.

The Chesapeake Bay which runs the length of the Coastal Plain drains both shores. From the Western Shore it receives a number of large tributaries among which may be mentioned the Northeast, Susquehanna, Bush, Gunpowder, Patapsco, Magothy, Severn, South, Patuxent, and Potomac rivers. On the Eastern Shore its principal tributaries consist of Bohemia Creek, Sassafras, Chester, Choptank, Nanticoke, Wicomico, and Pocomoke rivers. These streams, which are in the process of developing a dendritic type of drainage, have cut far deeper channels on the Western than on the Eastern Shore. If attention is now turned to the character of the shore-line, it will be seen that along Chesapeake Bay it is extremely broken and sinuous. A straight shore line is the exception and in only one place, from Herring Bay southward to Drum Point, does it become a prominent feature. These two classes of shore correspond to two types of coast. Where the shore is sinuous and broken, it is found that the coast is low or marshy, but where the shore-line is straight, as from Herring Bay southward to Drum Point, the coast is high and rugged as in the famous Calvert Cliffs which rise to a height of 100 feet or more above the Bay. The shore of the Atlantic Ocean is composed of a long line of barrier beaches which have been thrown up by the waves and enclose behind them lagoons flushed by streams which drain the seaward slope of the Eastern Shore. Of these Chincoteague Bay is the most important.

THE COASTAL PLAIN TERRACES.

It was stated in the early part of this chapter that the topography of the Coastal Plain was in reality more complex than at first appeared and that this complexity was due to a system of terraces out of which the region is constructed. The subaerial division of the Coastal Plain contains four distinct sets of terraces and part of another, while the submarine division is composed of one set only. This makes for the Coastal Plain as a whole a group of five sets of terraces. In describing these terraces, the author will anticipate somewhat material which will be discussed later in another place and will, for the sake of simplicity, designate these terraces, beginning with the highest, by the names of Lafayette, Sunderland, Wicomico, Talbot, and Recent. The first four and part of the fifth fall within the subaerial division and the last one principally within the submarine division of the Coastal Plain. All five of the subaerial terraces are found on the Western Shore while only three of them occur on the Eastern Shore. These terraces wrap about each other in concentric arrangement and are developed one above the other in order of their age, the oldest standing topographically highest.

Lafayette Terrace.—The highest of the five terraces is known as the Lafayette. It is best developed in Maryland in the region between the Anacostia, Potomac, and Patuxent rivers as far south as Charlotte Hall. In other words, it caps the divides at the northern extension of the southern Maryland Peninsula. The surface of this terrace varies considerably in appearance according to position. In the interior where it is removed from the influence of streams, it is as flat and featureless as any portion of the Eastern Shore, but along the margins where it has been dissected by waterways, they have transformed it into a gently-rolling country and its true character is obscured. Besides this extensive development of the Lafayette terrace, there are remnants of the same surface distributed along the border of the Piedmont Plateau from the Potomac River northeastward through Delaware and Pennsylvania to within a few miles of the Delaware River. There are also a few outliers scattered about the Coastal Plain. Most of these are grouped about the southern margin of the principal area in the vicinity of Charlotte Hall, a few more are found in Anne Arundel County, and a very important cluster occurs on the high hills of Elk Neck in Cecil County. Southward beyond the Potomac River this Lafayette terrace continues on through Virginia southward to Florida and Texas and over into Mexico. It is believed that at one time these scattered remnants of the

FIG. 1.—VIEW OF TALBOT TERRACE SHOWING WICOMICO ESCARPMENT, KENT CO.

FIG. 2.—VIEW OF CALVERT CLIFFS ON CHESAPEAKE BAY, CALVERT COUNTY.

VIEWS OF COASTAL PLAIN SCENERY.

Lafayette terrace were united in a continuous whole and that their present isolated condition has been brought about by erosion. If we assume that they were once continuous, it will be a simple matter to establish the present attitude of this terrace, notwithstanding the fact that its surface has been somewhat modified by erosion. In the Piedmont region of Cecil County the surface of the Lafayette terrace lies at an altitude of 470 feet. It rises to about 500 feet in the vicinity of Lochraven and Catonsville near Baltimore, to 486 feet at Burtonsville, Montgomery County, and again to 400 feet in the District of Columbia. Thus we see over a distance of about 80 miles that the surface of the Lafayette is relatively horizontal. This direction is, however, from northeast to southwest and approximately parallel to the trend of the modern coast line. If, now, the altitude of the Lafayette terrace is examined at right angles to this direction, namely toward the southeast, it is found that on the high hills of Elk Neck, in Cecil County, the surface of the Lafayette terrace lies at about 300 feet, making a slope in Cecil County of 170 feet in a distance of about 10 miles. At Charlotte Hall, St. Mary's County, the surface lies at a height of about 200 feet, making a slope between the District of Columbia and Charlotte Hall of 200 feet in a distance of about 36 miles. It will thus be seen that the surface of the Lafayette terrace has a slight incline toward the southeast or, in other words, slopes gently toward the ocean.[1]

[1] It will be explained later that this slope represents the gradual descent of a sub-aqueous terrace away from the shore-line out into deeper water. The elevation at the foot of the scarp represents the altitude of the old shore-line which, on account of oscillations in level, has been somewhat thrown out of a horizontal position since its formation, so that it lies at slightly different altitudes in various portions of the Coastal Plain. The altitudes recorded away from the scarp-line, show the elevations of the sub-aqueous terrace at varying distances from the ancient shore. These also have been slightly thrown out of their original position so that their former level attitude is now somewhat obscured. In any one locality, however, the various terraces from the oldest to the youngest occupy distinct levels and are usually separated by pronounced scarps, but when definite localities are compared the shore-line of one bench may be found to correspond in altitude at the present time with the deeper water phases of the next higher bench. This discrepancy, as has just been said, is due to tilting, and will be fully explained below.

Sunderland Terrace.—Beneath the Lafayette terrace, wrapping around it like a border, extending up into its body in re-entrants, and separated from it by a scarp-line is the next younger terrace designated above as the Sunderland terrace. This surface has its greatest development in southern Maryland on the Calvert and St. Mary's peninsulas. It covers the high divides of Calvert County and occupies a similar position in Charles and St. Mary's counties south of the Lafayette terrace. Beyond this region it is represented by outliers, many of which are several square miles in extent. They are principally found in the District of Columbia and in the region between the Patuxent and Patapsco rivers. There are also a number of smaller outlying areas which are distributed along the western border of the Coastal Plain between Baltimore and Elkton. South of the Potomac the Sunderland terrace continues on into Virginia, but as it has not been mapped in regions beyond Fredericksburg, it is not known how far in this direction it extends. Northward, beyond Maryland, this terrace has been found in Delaware and Pennsylvania and it is extensively developed in southern New Jersey.

The same statement may be made regarding this terrace as was made regarding that of the Lafayette, viz. that, in the interior where it has not been modified by erosion, it still retains its original level, featureless character, but along the borders where it has been attacked by the head waters of streams, it has been transformed into a rolling country. The relation between the surfaces of the Sunderland and Lafayette terraces becomes manifest whenever the two occur in juxtaposition. Then it is seen that they occupy different levels, that of the Lafayette always being higher than that of the Sunderland. This difference in altitude is sometimes slight, at other times it forms a prominent feature in the topography. Usually the descent from one to the other is gentle, but occasionally it is accomplished by means of an abrupt drop resembling in appearance a sea-cliff which has been modified by subaerial erosion.

Throughout the region as a whole there are distinguishable two types of descent between the Lafayette and Sunderland terraces. The one type is confined to the Piedmont Plateau, the other to the Coastal Plain, or, in other words, when the Lafayette terrace lies on the Piedmont Plateau and the Sunderland terrace rests beneath it either on the Piedmont or close to its eastern border, the descent from one surface to the other is usually considerable and is accomplished by a topography of low, subdued, rolling hills which pass down from the Lafayette terrace, occupying successively lower and lower areas until they finally blend with the surface of the Sunderland terrace beneath. This type of descent may be seen along the eastern border of the Piedmont Plateau between Cecil County and the District of Columbia. The other type of descent is found wherever the Lafayette and Sunderland terraces approach each other in the Coastal Plain. It may be described, as suggested above, as being an abrupt descent resembling a wave-cut cliff which has since been modified to a greater or less extent by subaerial erosion. The best localities for observing this type are to be found at Congress Heights just south of the Anacostia River in the District of Columbia, near Bryantown and Aquasco in Charles County, and at Charlotte Hall in St. Mary's County. Two only of these localities need be described. At Congress Heights the surface of the Lafayette terrace lies at an elevation of about 260 feet and that of the Sunderland at about 200. The descent between the two is accomplished by a cliff which is one of the most conspicuous features of the region and, in fact, of the entire Coastal Plain. There, as one stands on the unbroken Sunderland surface facing east, he may trace the cliff line separating him from the Lafayette terrace as it rises and runs off to the south until it is hidden from view by forest growth.

At Charlotte Hall and along the road running from Newmarket west over into Charles County, the surfaces of the Lafayette and Sunderland terraces approach very much nearer together than farther west. Throughout this region the Lafayette surface lies at an elevation of about 200 feet while the Sunderland rests about 20 feet below it at 180 feet. The descent from one to the other is here marked by a low scarp which does not exceed 20 feet in altitude, but while this topographic feature is less prominent than that at Congress Heights, it nevertheless partakes of the same character. Near Charlotte Hall there are a number of outliers of the Lafayette terrace which are separated from the Sunderland ter-

FIG. 1.—VIEW OF TRIBUTARY OF THE CHOPTANK, TALBOT COUNTY.

FIG. 2.—VIEW OF SUNDERLAND TERRACE SHOWING LAFAYETTE ESCARPMENT, ST. MARY'S COUNTY.

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race beneath by scarps of a similar character to the one just described, although one or two of them blend with the surface beneath without a well pronounced scarp-line.

It seems probable that the Sunderland surface was at one time continuous and embraced all of its outliers. If such was the case, it will be possible to establish the present attitude of the terrace. In the vicinity of Elkton and on Elk Neck, the surface of the Sunderland terrace lies at an elevation of about 180 feet where it abuts against higher land and slopes down toward the surrounding waters to about 90 feet. In the vicinity of Baltimore the surface slopes from about 200 to 230 feet to about 90 feet. In the District of Columbia the surface of the Sunderland also lies at about 200 to 230 feet and slopes gently toward the surrounding waters until it sinks to about 100 feet. In the vicinity of Charlotte Hall about 30 miles distant the surface of the Sunderland terrace, where it envelops the Lafayette, lies, as already stated, at about 180 feet and slopes gently down to the southern point of St. Mary's County where, near Ridge, it has an elevation of about 60 feet. In Calvert County the surface of the Sunderland terrace lies at an altitude of 160 feet and slopes toward the surrounding waters until it sinks to an altitude of about 95 feet. When these figures are compared, it will be seen that the Sunderland terrace slopes away very gradually toward the water in all directions from the enclosed areas of higher land. Along the margin of the Piedmont Plateau, that is to say, in a direction nearly parallel to the present shore, the difference in elevation of this surface is inconsiderable and in this respect resembles the attitude of the Lafayette terrace throughout the same area. But in all directions away from the Piedmont Plateau and from the base of the Lafayette terrace, the Sunderland surface slopes away gradually and regularly toward either the Atlantic ocean or the Chesapeake Bay and its estuaries. As the Sunderland terrace is practically unrepresented on the Eastern Shore, no observations are to be secured from that region.

WICOMICO TERRACE.—Beneath the Sunderland terrace occurs the Wicomico terrace. It bears the same relation to the Sunderland as the Sunderland does to the Lafayette terrace in that it wraps about it as a border, extends up into ancient stream valleys which enter it, and is separated from it by a well-defined line of low rises which, with the exception of the scarp-line cut by the present sea, constitute the most continuous topographic feature of the entire Maryland Coastal Plain. The distribution of the Wicomico terrace is somewhat different from that of the Sunderland and Lafayette terraces. It will be remembered that the Lafayette and Sunderland terraces found their greatest development on the divides of the peninsulas of southern Maryland. The Wicomico terrace, on the contrary, is best developed on the Eastern Shore. In that region it forms the flat, featureless surface of the divide, extending from Elkton southward to Salisbury and beyond, and from Chesapeake Bay on the west well over into Delaware toward the Atlantic Ocean on the east. From its surface, streams drain into both the Chesapeake Bay and the Atlantic. Outliers of this terrace are also found in great abundance along the Western Shore from Elkton down to Point Lookout. The greatest development on this side of the Bay is found in the region south of Baltimore between the Patapsco and South rivers. Beyond this territory, in the basins of the Patuxent and Potomac, the Wicomico terrace is developed in a manner strikingly different from that of the Eastern Shore. On the Eastern Shore, as was indicated above, it occupies a wide and almost unbroken territory. On the Western Shore it is developed as a narrow fringe around the base of the Sunderland terrace and as a floor of the ancient drainage valleys which penetrate the body of the Sunderland terrace as re-entrants. It was stated above that the scarp-line which separated the surface of the Sunderland from the Wicomico was one of the most prominent features in the Maryland Coastal Plain. This scarp-line has exactly the appearance of a wave-cut cliff which has been softened by subaerial erosion and resembles in every detail the similar topographic feature which has been described as separating the Lafayette and Sunderland surfaces. There are a large number of localities where this topographic feature may be seen, particularly throughout Calvert and St. Mary's counties. Perhaps four of the best and most accessible localities are located at Ridge in southern St. Mary's County not far from Point

Lookout; at the turn of the road a mile and a half south of Frazier near the 80-foot contour in Calvert County; in the region to the north of Maryland Point in Charles County; and along the Principio road, 1½ miles northeast of Perryville, Cecil County. Where the Wicomico terrace approaches drainage ways, it loses its typical plain character and is modified by erosion into a rolling country, but back in the interior where streams have not yet approached, the surface is typically a plain. In this particular it again resembles the Lafayette and Sunderland terraces. On the whole it has suffered less from erosion than those which lie above it. If we reconstruct the Wicomico terrace by uniting its outliers, we find that the surface of the Wicomico terrace stands at an elevation of 90 feet in Cecil County where it abuts against the Sunderland terrace, and slopes away toward the surrounding water to an elevation of 60 feet. In the vicinity of Baltimore and Washington and on the peninsula of Calvert County, between the Patuxent River and Chesapeake Bay the same general relation holds; but in St. Mary's County, between the Patuxent and Potomac rivers, the altitude of the Wicomico terrace, where it abuts against the Sunderland, gradually sinks until at Ridge the surface of the Wicomico terrace stands at 45 feet and slopes away gradually to Point Lookout until it ends at an elevation of about 15 feet. On the Eastern Shore the surface of the Wicomico terrace stands at an elevation of about 90 or 100 feet in the vicinity of Elkton, and at about 45 feet in its extreme southern development a few miles south of Salisbury. It will thus be seen that the surface of the Wicomico terrace maintains a remarkable uniformity throughout its entire extent along the border of the Piedmont Plateau but slopes gently toward the surrounding waters.

Talbot Terrace.—Beneath the Wicomico terrace occurs the Talbot terrace. This is the lowest of the subaerial terraces. Like the other members of the series, it envelops the earlier terraces, penetrates them as re-entrants and is separated from those above it by a scarp-line. This scarp-line, although usually lower and less conspicuous than that separating the Sunderland and Wicomico terraces, is easily discerned and is very continuous throughout the region. It may be typically seen at a large number of localities among which the following may be mentioned: along the borders of Elk River in Cecil County; on the road between Chestertown and Rock Hall in Kent County; in the vicinity of Brooklyn and Annapolis in Anne Arundel County; along the lower reaches of the Patuxent River in Calvert and St. Mary's counties, and about the flanks of Capitol Hill in Washington City.

This scarp has an average height of about 10 feet, although it at times disappears altogether and at other times may rise to 20 or 30 feet in altitude. The distribution of the Talbot terrace is similar to that of the Wicomico in that it finds its greatest development on the Eastern Shore although large areas are present along the western margin of Chesapeake Bay from Elkton southward to Point Lookout and in the valleys of all the estuaries. It has suffered less from erosion than any of the other terraces and maintains everywhere its original surface almost unmodified by the present drainage. The altitude of the Talbot terrace, where it abuts against higher land lies very constantly at an elevation of about 40 or 45 feet, except in southern St. Mary's County where it gradually declines southeastward to about 10 feet near Point Lookout. From its landward margin the Talbot terrace slopes away toward the surrounding waters where it either terminates in a wave-cut cliff or else passes down to tide-level and merges with the modern beach.

Recent Terrace.—Below the Talbot terrace is situated the Recent terrace. This is principally confined to the submarine division of the Coastal Plain and is co-extensive with it. It everywhere wraps around the subaerial division as a border and also extends up the river valleys as a terrace formed by Recent streams. Within the Bay and its estuaries it is identical with the wave-cut and wave-built terrace while along the Atlantic shore it forms the modern beach and extends seaward under the ocean as the surface of the continental shelf. Thus it appears that the Recent terrace is principally submarine. What is known regarding the contour of its surface has been determined by soundings. In this way it has been shown that the surface of this terrace is a plain, sloping gently from tide to a depth of 600 feet at a distance of about 100 miles off shore.

Up to this point in the discussion the various terraces have been described as wrapping around each other in concentric borders. This arrangement, although the typical one, is not always present, for frequently one or more terraces may be wanting in places where they would normally be expected to be present. At such times the descent from the surface of the highest to that of the lowest terrace present, amounts to the vertical distance which would normally be expected to exist between them. The best example of this is to be seen along the Bay shore from Chesapeake Beach southward to Drum Point. Throughout most of this distance the surface of the Sunderland terrace, lying at about 100 feet above tide, is separated from that of the Recent terrace at sea-level by a cliff 100 feet in height. The Wicomico and Talbot

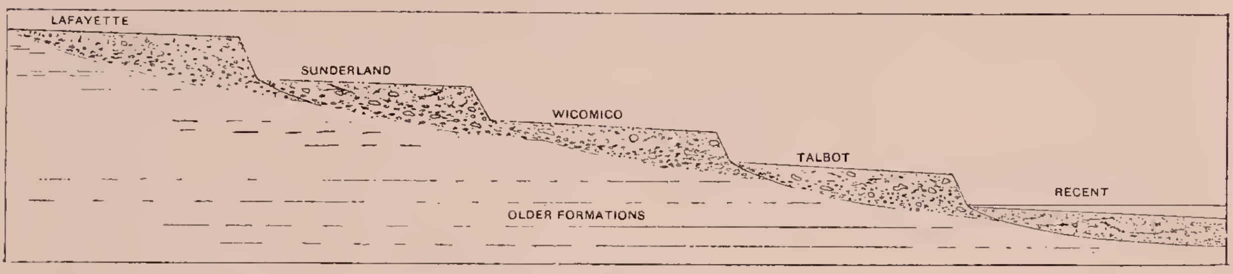

FIG. 4.—Diagram showing relative position of Coastal Plain Terraces.

terraces and their accompanying scarps are here absent and the descent from the Sunderland to the Recent terrace is accomplished by a precipice which makes the famous Calvert Cliffs.

Occasionally the surface of the Talbot and Wicomico terraces are modified by the presence of subordinate terraces separated by low scarp-lines. These secondary terraces are irregularly developed and, as a rule, are not extensive. They occur principally in the valleys of the important estuaries and along the banks of those tributaries which drain the surrounding upland. The most important of these minor scarps is developed on the Talbot terrace, facing the Atlantic Ocean, and extends from near Berlin northwestward to the vicinity of Newark, Delaware. It rises from 25 to about 35 feet and is a noticeable physiographic feature throughout the region where it is developed.

STREAM VALLEYS.

Within the Coastal Plain of Maryland there are discernible four generations of stream valleys. Three of these no longer contain the streams which cut them. They have been referred to in the discussion as re-entrants penetrating the various terraces. The first is found developed as a flat-bottomed drainage way of greater or less width and extent, running up into the Lafayette terrace. Its level bottom is an integral part of the Sunderland terrace. The second one of these drainage ways penetrates the Sunderland terrace in a similar way. Its characteristics are analogous to those entering the Lafayette terrace and its flat bottom forms an integral part of the Wicomico terrace. The third of these drainage ways cuts a re-entrant within the body of the Wicomico terrace and its level floor forms an integral part of the Talbot terrace. The fourth and last of these drainage ways is now in the process of formation. It is the system of valleys which are being cut by the Recent streams. Toward their headwaters these valleys are narrow and V-shaped, and if traced to their sources, are often found to start from intermittent springs surrounded by a steep-walled amphitheater from 5 to 10 feet in height. Toward their lower courses these valleys are broad and flat and are frequently filled with fresh or brackish water marshes. In the upper portions of their courses the valleys are being eroded. In the lower portions they are being filled. A glance at the map will serve to confirm the opinion which has been held for a long time, namely, that the rivers of the Coastal Plain of Maryland have been drowned along their lower courses, or, in other words, have been transformed into estuaries by the subsidence of the region. The filling of these valleys has taken place toward the heads of these estuaries. The headwaters of these Recent valleys are being extended inland toward the divides with greater or less rapidity.

Many of the tributary streams occupy the re-entrant valleys described above. The more energetic have succeeded in carrying out all of the ancient floors which formerly covered these valleys and formed a portion of the various terraces. Others have left mere remnants of these valley accumulations along the margins while the less active streams have left the re-entrant valleys practically unmodified. In Southern Maryland the streams which drain into Chesapeake Bay from the eastern slope of Calvert County, as well as those which drain into the Patuxent River from St. Mary's and Prince George's counties, have shorter courses than those which drain into the Patuxent from Calvert County or into the Potomac from Prince George's, Charles, and St. Mary's counties. A similar contrast is obvious between the streams which enter the Atlantic Ocean from the Eastern Shore and those which enter Chesapeake Bay from the same region.

The cause of this shortening of streams on the northeast side of these divides is probably due not only to a tilting toward the southeast which is discussed elsewhere, but also in a great measure, particularly along the Bay shore, to rapid wave erosion. The streams draining the eastern slope of Calvert County and the northeastern slope of St. Mary's and Prince George's counties were at one time longer, but the recession of the shore line has shortened their courses by the cutting away of their lower valleys. This is very clearly shown along the Calvert Cliffs where the waves have advanced so rapidly on the land that the former heads of stream valleys are now left as unoccupied depressions along the upper edge of the cliffs, while other streams cascade from the top of the precipice to the shore beneath, and still others more active have been able to sink their valleys to the water's edge by a very sharp descent. Other investigations have suggested that rotation may have had some influence in bringing the streams mentioned above into their present position, and although the streams are short, it is possible that they have been somewhat affected by this influence.

ECONOMIC PHYSIOGRAPHY OF THE COASTAL PLAIN.

Soils.—The various geological stages through which the Coastal Plain has passed have had considerable influence upon the soils, and through them upon the crops of the province. The early strata, those of Cretaceous and Eocene age, which are best developed in parallel belts along the northwestern boundary of the Coastal Plain, are sandy loams which yield good returns of fruit and garden truck. In this belt the very prosperous peach—and other fruit—farms have been located, and large quantities of fine peaches are still shipped from the northern counties of the Eastern Shore. The same belt extends northeastward into Delaware and New Jersey where similar crops are raised. These strata carry with them a natural storehouse of valuable fertilizer in the form of greensand or glauconitic shell marl. In the early days of Eastern Shore farming, this marl was much used as a fertilizer, particularly in Cecil, Kent, and Queen Anne's counties.

In the central and southern counties the clayey loams which come from the Miocene or Chesapeake deposits afford extensive areas of good wheat, grass, and tobacco lands, which formerly were of great importance to the State. Since the rapid development of the wheat fields of the West, however, the yield of these lands has become comparatively insignificant, so that at present the farmers are not able to make wheat crops pay even by the aid of expensive fertilizers. Among the best-paying crops of the Coastal Plain are the products of the lighter sandy loams of the Pliocene (Lafayette) and Pleistocene deposits. These soils cover the whole Eastern Shore south of the Choptank and are also of importance on the more dissected Western Shore. Large and early crops of berries and melons are annually shipped from the cultivated areas of these soils, and the canning of tomatoes, corn, and other products constitutes one of the important industries of the province.

Waterways.—The post-Lafayette and the post-Pleistocene submergences of the Coastal Plain have been of immense benefit to the inhabitants of Maryland. As a result of the drowning of the Chesapeake River ocean-going vessels are admitted as far inland as Georgetown, D. C., Baltimore, Havre de Grace, and Chesapeake City. Valuable harbors also are provided, so that much commerce has been attracted to Maryland shores. Besides interstate and international trade which is thus favored by the configuration of Chesapeake Bay with its deep exit to the high seas, trade within the State is greatly benefited by these waterways. That geologically recent submergence, whereby the river valleys carved in post-Pleistocene times were drowned for more than half their length, gave to the inhabitants of the Coastal Plain the most favorable facilities for easy and cheap transportation of their crops. The estuaries then formed are the entrances to tidal streams that penetrate into the very heart of the rich lands. They are generally of sufficient depth to admit the light-draught steamers plying on the waters of Chesapeake Bay and the numerous wharves which are encountered on ascending any one of the navigable creeks testify to the readiness with which the people have availed themselves of their natural opportunities. In the proper seasons these wharves may be seen piled high with the crates of fruit and other products which are being sent to Baltimore for distribution among the neighboring states.

Besides thus affording easy paths of intercourse with other important sections of the State the estuaries yield peculiar and characteristic products of their own. The same streams which, during the summer, are the arteries and highways of a commerce based on the products of the soil, become in winter the fields of one of Maryland's greatest industries—the oyster fisheries. Great quantities of these oysters are annually sent to Baltimore, and their gathering has given rise to a race of hardy fishermen and expert sailors only excelled by the codfishers who sail every year to the Great Banks of Newfoundland. The oyster-canning industry, whereby the interior of the continent is supplied with canned oysters, has also arisen as an indirect result of the post-Pleistocene submergence. The diamond-back terrapin, the duck, and the other wild fowl of the littoral marshes also deserve a place among the list of resources which the geographic history of the province has bestowed upon this State.

Railroads.—While the many waterways which intersect the Coastal Plain have given boat traffic the best start among transportation facilities, railroads have been built to a number of points, thus connecting them more directly with the vigor and energy of the great commercial centers of Baltimore, Philadelphia, and New York. Generally the railroad, seeking as it does that course which requires the least modifications from the natural topography in order to make an easy grade, has to pursue a more or less tortuous route. On the Eastern Shore the low and almost insignificant character of the divides and the shallow stream valleys permit the roads to run in very direct routes from one objective point to the next. A glance at the map of the State shows these routes and the indifference which they display towards the divides. It is also noteworthy that, although touching at several waterside towns, the railroads are confined on the whole to those wider portions of the small peninsulas where the hauling distance to the boat lines becomes something of a factor in the cost of transportation. By reaching these remoter points they are thus able to maintain a foothold in spite of the lower rates offered by the boat lines. On the peninsula of Southern Maryland the few railroads are compelled to hold pretty closely to the divides, as a short distance on either side the country becomes so cut up that it would be wholly impracticable to build a line.

Effect of Topography upon the Inhabitants.—When the early settlers came to Maryland they found the tracts of the Coastal Plain occupied by peaceful tribes of Indians who lived by fishing in the deeply indented rivers and hunting through the pine and hard-wood forests which covered the inter-stream areas. The settlers themselves took to farming, encouraged by the rich soils, and also obtained plenty of fresh fish and oysters from the neighboring waters. Soon large and prosperous plantations grew up, which afforded by their products good incomes to their owners. The earlier inhabitants were thus mainly agriculturists. As the value of the oyster beds increased, and the demands for the oyster grew, the race of oystermen sprang up. These men naturally settled along the shores near their work. At present the two classes, which originally must have been somewhat mixed, can be clearly distinguished, the regular farmer keeping to the higher inter-fluviatile areas, while along the shores and in the vicinity of the large towns are the houses of the oystermen. On the Western Shore the dissection of the interior lands near the Bay has handicapped the farmer very decidedly, while the deep rivers and estuaries give good opportunity for the fishermen to ply their trade.

Thus the geological and physical features of the Coastal Plain, which are the direct results of its geological history, are seen to have almost wholly determined the pursuits and the habits of its settlers and inhabitants.

The Piedmont Plateau.

The Piedmont Plateau, which is the name applied to the hill country that borders the Coastal Plain on the west and extends thence to the foot of the Appalachian Mountains, is a low plateau of complex origin whose rolling surface is traversed by highlands and cut by valleys that at times trench the uplands as deep gorges. From the fact that the physiographic features of the Appalachian Region which lies to the westward are contemporaneous in origin with those of the Piedmont Plateau it is reasonable to suppose that no sharp line can be drawn between the two districts. The boundary can in fact with almost equal propriety be placed at the foot of North Mountain as at the foot of the Catoctin Mountain, although all things considered, it has seemed best in Maryland to divide the two regions at the point where the first pronounced mountain range is reached.

To the northward the Catoctin and Blue Ridge highlands with their South Mountain extension in southern Pennsylvania, gradually decline to the level of the lower plateau, and the surface of the Piedmont hill country with higher lands of inconspicuous elevation extends to the foot of the Alleghany ranges. To the southward, on the other hand, the Great Valley is less pronounced and the highlands of the Blue Ridge become a conspicuous part of the great Appalachian Region. In the south also the name Piedmont has become so widely intrenched in usage for the district lying to the eastward of the Blue Ridge mountains that it has seemed best to follow the same usage in Maryland.

THE DIVISIONS OF THE PIEDMONT PLATEAU.

The Piedmont Plateau is divided into two regions called respectively the Eastern Division and the Western Division which are separated by Parrs Ridge that gradually rises to an elevation of several hundred feet above the general surface of the Piedmont Plateau. This highland has an average elevation of 800 to 900 feet, rising to the northward in Carroll County and in the nearby regions of Pennsylvania to 1100 feet but gradually declining southward across Howard and Montgomery counties until it reaches the lowland elevations of the Piedmont Plateau toward the Potomac Valley.

Parrs Ridge forms the divide between the streams flowing directly into the Chesapeake Bay and those flowing into the Potomac River. Among the more important streams entering the Chesapeake from the eastern division of the Piedmont are the Susquehanna, Bush, Gunpowder, Patapsco, and Patuxent rivers. The western division is largely drained by the Monocacy River and its tributaries into the Potomac River.

THE PIEDMONT PENEPLAINS.

The Piedmont Plateau is made up of remnants of old plains cut out of the high plateau that formerly stretched across the district from the Appalachian Region and passed beneath tide just beyond the edge of the Coastal Plain where it now forms the floor on which the Coastal Plain sediments rest. The eastern division is much less deeply eroded than the western with the result that more frequently remnants of the oldest plains are found in the former than in the latter district. On the other hand, the later plains, but poorly developed along the eastern margin of the Piedmont, become gradually more pronounced westward, the youngest plains being well defined in the drainage basis of the Monocacy and along the Potomac. These old plains, now represented only by remnants of their earlier surfaces, are technically known as peneplains by physiographers. A *peneplain* is the name given to an area that has been reduced by erosion to approximately a level surface but little above the sea level of the period of its formation, but which may still have unreduced knobs or *monadnocks* in the inter-stream areas. Even where these monadnocks have largely wasted away the valley surfaces would naturally be somewhat lower than the divides and would rise slowly to the sides of the valleys as well as from the lower courses of all the streams to their heads. It is important to keep these facts in mind when endeavoring to reconstruct the ancient peneplain surfaces from the remnants of the old plains that are still left in the Piedmont district. It so happens that after the formation of the oldest peneplain now represented, later erosion has only resulted in the partial development of new plains, highlands, sometimes of wide extent, still remaining as monadnocks in the inter-stream areas.

The several plains recognized in the Piedmont district are known as the Schooley, the Weverton, the Harrisburg, and the Somerville peneplains, all of which, like the district to which they belong, have been traced far beyond the confines of the State.

SCHOOLEY PENEPLAIN.—The Schooley peneplain, so named from Schooley Mountain in Pennsylvania, is represented in the higher crests of Parrs Ridge and throughout the eastern division of the Piedmont Plateau. A conspicuous remnant of this old plain is also shown in the crest of Sugar Loaf Mountain in the western division of the district while the same surface is continued westward in the more or less level crests of the Catoctin and Blue Ridge mountains. This old peneplain which has a nearly uniform elevation of 1800 feet throughout the eastern portion of the Appalachian Region, slopes more rapidly from the crest of the Catoctin Mountain eastward, being represented in Sugar Loaf Mountain at a height of about 1300 feet and in Parrs Ridge at an elevation of 1000 to 1100 feet, the greatest heights being found toward the Pennsylvania line. Across this western district the slope is about 30 feet to the mile. To the east of Parrs Ridge the Schooley peneplain declines more rapidly, being represented in Harford, Baltimore, and Howard counties at constantly lower elevations that finally reach 400 feet or less at the margin of the Coastal Plain where the slope has increased to 40 or 50 feet in the mile, as shown by the dip of the basal formations of the Coastal Plain series and by well-borings that have penetrated the later sediments to the Coastal Plain floor. An explanation for the much more complete preservation of the Schooley peneplain surface in the eastern portion of the Piedmont Plateau and particularly near the Coastal Plain margin must be sought largely in the lower elevation of this plain during the formation of the later plains, and no doubt also in part from the fact that it was in a measure protected by the cover of Coastal Plain sediments which are known to have extended farther westward than at present.

The age of the Schooley peneplain is probably Jurassic. It must have been formed later than the deposition of the red sandstones and shales of Triassic age in the Frederick Valley and earlier than the deposits of the earliest Coastal Plain sediments which are either of late Jurassic or early Cretaceous age. At the time of the formation of the Schooley peneplain the land surface must have extended far to the eastward of its present known limits and such deposits as were laid down along its eastward margin must be now deeply buried beneath the Coastal Plain and may even have been deposited to the eastward of the present coast line.

Weverton Peneplain.—The Weverton peneplain, so called from its development on the ridge of Weverton sandstone north of Weverton, has many broad level-topped remnants throughout the Piedmont district which vary in elevation from about 700 feet in Montgomery County to 850 feet in northern Carroll County. To the westward the surface rises on an average slope of about 30 feet in the mile and although imperfectly shown on the eastern flank of the Catoctin Mountain it may be clearly recognized along the crest of that mountain, in the Middletown Valley, and toward the Potomac River where it reaches an elevation of about 1200 feet. Eastward from the Parrs Ridge district it gradually declines across the central counties until it reaches an elevation of 300 feet or thereabouts along the Coastal Plain margin, being here represented in the broader valleys that trench the Schooley surface. This is admirably shown in the Green Spring and adjacent valleys in Maryland and in others beyond the State where the later Potomac formations lie directly on the limestone of the valley floors. At the margin of the Coastal Plain the Weverton peneplain can be no longer recognized with certainty and doubtless gradually merges into the older Schooley surface out of which it was carved. It is possible that some of the known inequalities of the Maryland Coastal Plain floor may be due to the eastward extension of some of the Weverton Valleys, although the low elevation of this area, the gradual approach of the two surfaces and the cover of Potomac and later sediments make it extremely difficult to determine this point positively.

The age of the Weverton peneplain is doubtless late Jurassic or early Cretaceous since the later Potomac deposits rest upon its surface. Whether all of the Potomac deposits were laid down subsequent to the formation of this plain cannot be with certainty determined although the suggested extension of some of the Weverton valleys beneath the oldest beds renders this interpretation possible. Without more definite proof on this point, however, it is perhaps safer, as has been already done, to regard the Schooley surface as affording the floor upon which the earlier deposits were spread.

It is possible that a warping of the Schooley peneplain, during the formation of the Weverton plain and subsequently, affected the Coastal Plain floor throughout much of the western portion of that district, as shown by the non-marine Potomac deposits of the Maryland Region, indicating the exclusion of the basin of sedimentation by a land barrier.

HARRISBURG PENEPLAIN.—The Harrisburg peneplain, so named from its occurrence about Harrisburg, Pennsylvania, where level-topped surfaces representing this peneplain are well displayed, lies at an elevation of about 600 feet in the eastern part of the Appalachian district and thence gradually declines eastward, reaching about 500 feet in the lower Monocacy Valley. To the northward along the Monocacy drainage basin this level slowly rises toward the headwaters of the Monocacy as well as laterally to the interstream highlands represented by the Catoctin Mountain on the west and the Parrs Ridge district on the east. The broad highlands of the Weverton Plain apparently confined the surface of the Harrisburg peneplain to the western division of the Piedmont Plateau. Farther down the Potomac Valley the Harrisburg surface gradually declines to 400 feet, but its identity becomes largely obscured toward the Coastal Plain border where it probably merges into the older peneplains. At all events, it cannot be satisfactorily discriminated. Throughout most of the district to the east of Parrs Ridge the Harrisburg peneplain is evidently represented only by the deeper trenching of

FIG. 1.—PATAPSCO VALLEY AT THE MOUTH OF BRICE'S RUN, BALTIMORE COUNTY.

FIG. 2.—LEVEL SURFACE OF PIEDMONT PLATEAU AWAY FROM MAIN DRAINAGE LINES, CECIL COUNTY.

VIEWS OF PIEDMONT SCENERY.

the floors of the Weverton valleys although this cutting has been continued at various times until the present.

The marked change in slope shown by the Schooley and Weverton peneplains to the eastward of the Catoctin Mountain is for the most part lost in the case of the Harrisburg and Somerville peneplains, indicating that the elevation which went on subsequent to the formation of the Schooley and Weverton surfaces must have largely ceased by post-Harrisburg time.

The age of the Harrisburg Plain has been thought to be early Tertiary, deposits of supposed late Tertiary age having been found to rest upon it. The data necessary to determine closely the time of its formation are absent. A study of the Coastal Plain sediments has not afforded such results as to warrant a close correlation of this plain with the formations of that area.

SOMERVILLE PENEPLAIN.—The Somerville peneplain, so called from its development near Somerville, New Jersey, is not widely separated from the Harrisburg peneplain above discussed. It has an elevation of about 500 feet in the eastern part of the Appalachian district in the vicinity of Harpers Ferry, from which region it declines for some distance with about the same slope as that of the Harrisburg already described. Like the Harrisburg Plain, it can be traced up the Monocacy basin, gradually rising toward the headwaters and toward the divides to the east and west. Along the Potomac Valley it declines eastward to 350 feet, beyond which it evidently gradually merges with the older surfaces. Throughout the greater part of the eastern district of the Piedmont between Parrs Ridge and the Coastal Plain border it is only represented, as far as can be determined with certainty, by the deeper trenching of the valleys which had already commenced their cutting in the Weverton surface in Harrisburg time.

Both the Harrisburg and Somerville plains were doubtless developed along the drainage lines entering the region of the older Coastal Plain deposits although evidence of this extension is probably no longer apparent in the case of the Harrisburg. At least no satisfactory proof can at present be deduced for it. The revival of erosion with the elevation of the Harrisburg surface may have resulted in the deposition of the coarser sediments of middle and late Tertiary time, while the revival of erosion in post-Somerville time is doubtless represented by the Columbia deposits which have been formed from the materials removed during successive epochs of post-Somerville denudation. The age of the Somerville Plain would, therefore, be late Tertiary.

STREAM VALLEYS.

The present streams are now found in valleys of variable depth that trench the peneplain surfaces. In the eastern division of the Piedmont where the Harrisburg and Somerville plains are at best but poorly developed the streams appear for the most part as trenches in the Weverton plain. In the western divisions, on the other hand, they are found trenching the later peneplains and in the lower Monocacy and Potomac valleys the relations of the streams to the Somerville peneplain are clearly defined.

Some of these streams are more or less adjusted to the underlying rocks as in the case of Jones Falls to the north of Baltimore but a large portion of them are discordant, that is, seemingly unaffected by the rocks over which they flow. In the eastern division of the Piedmont the streams flow down the eastern slope of Parrs Ridge in approximately parallel courses to the Chesapeake Bay and in many instances the streams cut across the rocks with little regard to their physical characters. In the case of the Monocacy and its tributaries we find that there has been little adjustment of the channels, the streams taking their courses across limestones, phyllites, and shales indifferently.

In general, both the main streams and their tributaries show drainage patterns similar to those of the Coastal Plain, and it is not impossible that the stream courses may have been in many instances superimposed on the rocks at no distant time in the past through a mantle of Coastal Plain sediments. Remnants of such a cover have been found far removed from the main body of the Coastal Plain, even as far westward as the Great Valley.

ECONOMIC PHYSIOGRAPHY OF THE PIEDMONT PLATEAU.

The physiography of the Piedmont Plateau has materially influenced the settlement and occupation of those who chose this region for their homes.

SOILS.—The early settlers, having to raise all their food, naturally sought out the best locations for their broad farms and beautiful estates. On their arrival they found two general classes of farm-lands.

The first class embraced the somewhat rolling but extensive tracts of the interstream upland areas. The soils were found to be good producers of corn, wheat, and grass, and the surface not so rough as to make its cultivation forbiddingly difficult. The long continuous tracts of these interstream areas also made travelling easy as long as one stayed on the upland, while the stream valleys were shut in and narrow. For these reasons, probably, the various stately manor lands were laid out where the upland expanses were greatest; and the mansions, surrounded by fine groves and broad fields, were located on the most promising of the small plateaus. In the earlier days the crops from these broad upland farms were among the richest in the State and rivaled those of the Eastern Shore.

The second class of farm-lands comprised the alluvial loams and sandy flood-plains along the streams. These lands are generally restricted in area, since the valley bottoms are usually narrow and limited in extent. Where streams have opened out lowlands on the marble and limestone areas rich lands of considerable extent offer most favorable farm sites. The lands along the streams have the advantage of running water and good springs from the hill-sides, they are not as well drained, however, as are the lands of the upland, and they are subjected to damaging floods. Comparatively few settlers chose the valley lands at first.

A marked exception to the above rule is found in the Monocacy Valley, where the farm-lands are all located on the several benches and terraces leading down to the river or on the low bottom-lands belonging to it. So little of the old upland is left that the conditions of occupation are quite different from those farther east.

Streams.—While the farming class were searching for good soils and favorable homestead sites, the manufacturers and millwrights were seeking favorable locations for mills, dams, and flumes. The streams of the Piedmont Plateau yielded a great abundance of water-power, and soon mills dotted the valleys. Each section early came to be supplied with its grist mill, and in due time cotton mills were also built. These industries in time became of great importance. The flour mills are now generally abandoned, however, only a few of the most favorably situated ones having been able to maintain themselves against western competition. The cotton mills have held out much better, because it has not been until recent years that southern cotton has been spun and woven at home.

The water-power which the Piedmont streams furnish is not the only wealth which they bring to the State. The land movements during late geological time have caused the streams to trench their courses considerably, and in so doing have rendered accessible the building stones which were previously hidden beneath the surface. The granite now extensively quarried at Port Deposit would not be so easily obtained and shipped had not the Susquehanna River cut its deep gorge. The locations of the serpentine quarries of Harford County are determined to a greater or lesser extent by the streams which intersect the rock. A formerly important soapstone quarry on Winter Run in the southeast corner of Carroll County was made possible only through the fact that the stream had there cut a deep gorge in a long band of steatitic serpentine. Along the Patapsco and Jones Falls many quarries of granite and gneiss have been located because the stream gorges offered favorable openings or transportation facilities.

It is interesting, by way of contrast, to compare the different conditions under which the Cardiff-Delta slates are quarried. As no stream cuts across Slate Ridge in the vicinity of those two settlements, the quarries have been located along the summit and are worked entirely from above. This is the most difficult way to attack the slates, and as there is no natural drainage for the quarries the water which is constantly accumulating in the pits greatly increases the cost of working.

LINES OF COMMUNICATION.—The valleys and ridges of the Piedmont Plateau furnish excellent examples of the way in which topographic features influence commerce and human activities.

One of the first acts of the early settlers of the Piedmont region was to lay out highways. These early roads were not always located advantageously with reference to the topography, but both the divides and the valleys were extensively employed. When the better turnpikes came to be built, however, they were almost without exception built along the divides. The reason for this was that fills and bridges were thereby avoided and better drained road-beds, not subject to floods, were obtained. Radiating in all directions from Baltimore, these old turnpikes may be followed into almost every corner of the State, and their location on the more elevated ridges enables the traveler to obtain beautiful views of the richly wooded, rolling uplands and tree-filled valleys.

With the advent of the canals and railroads more even grades were demanded and sought for. They were found by following the larger valleys.

The canals were built to overcome the obstructions to navigation which the "fall line" rapids occasioned, even in the larger streams such as the Susquehanna and the Potomac.

One of the early canals was the Susquehanna Canal, built along the east shore of the Susquehanna River in order to transport merchandise from the limits of navigation at Port Deposit northward along that stream to the Pennsylvania line. This canal has now wholly fallen into disuse.

Another early and successful canal was constructed around the Great Falls by the Potomac Company. To obtain the necessary water and the most favorable grades this channel, now part of the Chesapeake and Ohio Canal, was laid out along the north bank of the Potomac, taking advantage of the natural trenches cut by that river. This canal was long the cheapest and best means of transportation between the coal and wheat lands of Allegany County and tidewater.

Since the era of railway construction began every advantage has been taken of the topographic features of the country. The Baltimore and

Ohio Railroad crossing the Piedmont Plateau from tidewater found an easy exit from the depression about Baltimore and a gentle, though crooked, grade to the crest of the divide by following up the South Branch of the Patapsco River to Mount Airy, and then along the Monocacy drainage to Point of Rocks.

The Western Maryland Railroad, striking north and then westward, could not utilize the lower course of the North Branch of the Patapsco on account of its narrow valley and very crooked channel. By following the broad, well-graded valley of Gwynns Falls as far as Emory Grove, however, an easy descent was found into the more favorable upper course of the North Branch of the Patapsco and thence an easy grade led to the sag in the divide at Westminster. A branch of the Western Maryland road running north from Emory Grove follows the Gunpowder-Monocacy divide as far as Manchester.

The Northern Central Railway enters the State from the north by following down the main branch of the Big Gunpowder and does not leave this stream until at Ashland the broad marble lowlands about Cockeysville open out and offer an easy crossing to the valley and gorge of Jones Falls, which it follows down to Baltimore from Lake Roland.

A striking example is afforded by the Maryland and Pennsylvania Railroad which takes advantage of the gorge of Deer Creek to penetrate Rocky Ridge. Were it not for the aid thus rendered by the creek the engineers of the road would have been obliged to tunnel through the obstruction or else have gone a number of miles out of a direct course. Deer Creek would not have been located across the quartzite and so could not have cut the gorge had it not accidentally taken this position while flowing on the Coastal Plain covering from which it was doubtless superimposed upon the quartzite. Besides the railway a county road also utilizes this gap and there are reasons to suppose that before the advent of the white man the Indians also used it as a thoroughfare.

In conclusion it appears that the topography has very materially controlled the settlement and economic development of the Piedmont Plateau, by determining the location of the farms, the mills, and the railroads.

APPALACHIAN REGION.

The Appalachian Region borders the Piedmont Plateau upon the west and extends to the western limits of the State. It consists of a series of parallel mountain ranges with deep valleys which are cut nearly at right angles throughout much of the distance by the Potomac River. Many of the ranges exceed 2000 feet in elevation while some reach 3000 and more in the western portion of the district. The streams have been to a large extent adjusted to the rocks over which they flow, although this is less evident in cases of the master stream, the Potomac River, than of the tributaries.

THE DIVISIONS OF THE APPALACHIAN REGION.

The Appalachian Region is divided into three districts, known as the Blue Ridge district, the Greater Appalachian Valley, composed of the Grèat Valley and the Alleghany Ridges, and the Alleghany Plateau. Each district presents certain marked physiographic characteristics that separate it from the adjacent areas on the east and the west.

The Blue Ridge district consists of the Catoctin and Blue Ridge mountains uniting to form the greater highland of South Mountain in the southern part of Pennsylvania. Beginning with an elevation of 2000 feet at the Maryland line this highland gradually declines southward to the Potomac River where it has an elevation of less than 1500 feet at Maryland Heights overlooking the Potomac Valley. The eastern border of this district is formed by the Catoctin Mountain which extends as an almost unbroken highland from the Pennsylvania line to the Potomac River at Point of Rocks. Succeeding the Catoctin upon the west is the Middleton Valley which drains southward into the Potomac River through the Catoctin Creek. Along the western side of this district is the Blue Ridge Mountain proper. It extends as a sharply defined range from the South Mountain of Pennsylvania to the Potomac River which it reaches at Weverton. Its crests form the boundary line between Frederick and Washington counties. The Blue Ridge in Virginia is not the direct continuation of the mountain so named in Maryland but of a smaller range, the Elk Ridge, which adjoins the Blue Ridge on the west and reaches the Potomac River at Maryland Heights opposite Harpers Ferry.

The Greater Appalachian Valley embraces all of the country lying between the Blue Ridge on the east and Dans Mountain or Alleghany Front on the west. It admits of a two-fold division into the Great Valley on the east and the zone of Alleghany Ridges on the west. The Great Valley, known as the Hagerstown Valley in Maryland, the Cumberland Valley in Pennsylvania, and the Shenandoah Valley in Virginia, is a broad lowland, the floor of which averages from 500 to 600 feet in elevation, gradually increasing in height from the Potomac Valley toward the Pennsylvania line. It extends from the Blue Ridge on the east to North Mountain on the west. It is drained by the Antietam River on the eastern side and the Conococheague River on the western side, both of these streams having their sources in Pennsylvania and flowing southward to the Potomac River. The Alleghany Ridges which extend from North Mountain to the Alleghany Front consist of a series of parallel ranges of varying elevations that extend from north to south across the State. Among the more important are North Mountain, Tonoloway Ridge, Sideling Hill, Town Hill, Green Mountain, Warrior Mountain, Collier Mountain, Martin Mountain, Nicholas Mountain, Shriver Ridge, and Wills Mountain. Between them are valleys that are drained mainly to the southward into the Potomac River. They vary in character, some being narrow and deeply trenched, while in others broad level-topped areas appear, the origin of which will be shortly discussed.

The Alleghany Plateau forms the western part of the Appalachian Region and extends from the Alleghany Front to the western limits of the State. This highland, like the districts which lie to the eastward, is continued far beyond the confines of the State. To the southward it can be traced through Virginia, Kentucky, and Tennessee to northern Alabama where it is known under the name of the Cumberland Plateau. In Maryland this district consists of a broad highland across which ranges of mountains extend from northeast to southwest, reaching elevations of 3000 feet and more at several points in Big Savage, Great Backbone, and Negro mountains. The leading ranges of the district are Dans Mountain, Big Savage Mountain, Great Backbone Mountain, Negro Mountain, Winding Ridge, and Laurel Hill. The streams flow in part to the southward or eastward, as the case may be, into the Potomac River and in part to the northward through the Youghiogheny Valley into the Monongahela River whence the waters reach the sea through the Ohio and the Mississippi. The latter district comprises much the larger part of Garrett County.

THE APPALACHIAN PENEPLAINS.

The Appalachian Region, like the Piedmont Plateau, is composed of remnants of old plains which have been cut out from the high plateau, now represented by the level-topped crests of the highest ranges. The several peneplains succeed each other at different elevations, being represented by the low crests or broad level-topped valleys that are here and there preserved in the highland region.

The peneplains found represented in the Appalachian Region are the continuations westward of the Piedmont peneplains and like them have here and there above the ancient surfaces unreduced knobs or monadnocks in what were probably interstream areas. As in the Piedmont district, the peneplain surfaces rise gradually up the old streams and toward the valley sides.

The Appalachian physiographic history is complicated by the fact that the drainage of the area has evidently changed during the period of peneplain development, the Potomac drainage having gradually encroached upon that of the Youghiogheny to the westward. It is probable, therefore, that the peneplains to the west of the Alleghany Front as well, perhaps, as those a short distance to the east of the same cannot be readily correlated with those farther eastward. On account of the higher gradient of the Potomac and its head-water tributaries compared with the Youghiogheny and the drainage basin of which it is a part an encroachment of the former would, in accordance with known physiographic laws, naturally result. In this way certain physiographic incongruities and even biological peculiarities in the distribution of the faunas of the present day may be explained.

The peneplains recognized in the Appalachian district are known as the Schooley, Weverton, Harrisburg, and Somerville plains, all of which are found in the Piedmont district to the east.

Schooley Peneplain.—The Schooley peneplain which we have already found to be represented in the higher crests of the Catoctin and Blue Ridge mountains, where it has an elevation of about 1700 feet, is continued in North Mountain. To the west of this ridge it is again recognized in the level-topped crest of Town Hill where it still has an elevation of little more than 1700 feet, beyond which it rises gradually in Warrior Mountain to an elevation of about 1800 to 1900 feet, in Martin Mountain to an elevation of a little under 2000 feet, in Evitts Mountain to somewhat over 2200 feet, and in Dans Mountain to about 2500 feet. To the westward it is found in Big Savage and Great Backbone mountains at an elevation of about 3000 feet.

The Schooley peneplain is thus found to possess a different slope in the different portions of the Appalachian Region. Throughout the eastern portion of the area from Catoctin Mountain to Town Hill, a distance of nearly 50 miles, the peneplain surface is nearly horizontal while to the westward of this point it slopes at first gradually and then more rapidly to the crests of Great Backbone Mountain. The slope of the surface throughout the central portion of this region is from 30 to 40 feet in the mile but it rises to 60 feet in the mile in the western portion of the district.

The Schooley peneplain is closely related to the geology of the district in that the level-topped crests which to-day rise to the old Schooley surface consist of the hard unyielding sandstones that have withstood the processes of erosion while the associated shales and limestones have been gradually reduced by the elevation of the formations in subsequent periods.

Weverton Peneplain.—The Weverton peneplain which is most clearly developed in the central Piedmont district, where it has an elevation of about 750 feet, is found represented in the crest of the Catoctin Mountain toward the Potomac River at about 1200 feet as well as in the Blue Ridge near Weverton and in Elk Ridge at Maryland Heights, the latter having an elevation of about 1300 feet. From this point westward it remains nearly horizontal for many miles, in this respect corresponding to the Schooley plain already described. In Green Ridge it is still recognized at an elevation of somewhat over 1300 feet, in Boyer Knob at an elevation of about 1500 feet, and in Nicholas Mountain at an elevation of about 1800 feet.

The attitude of the Weverton plain has many points of resemblance to that of the Schooley peneplain already described. From the Catoctin Mountain westward it rises very slowly as far as eastern Allegany County, beyond which point it rises more rapidly throughout the central portions of that county at the rate of about 30 feet in the mile to its highest recognized level in Wills Mountain.

It is difficult to correlate this plain with the broad, level-topped upland in Georges Creek and in the glades of Garrett County which reach an elevation of about 2500 feet. It is probable, as earlier explained, that the drainage of the region has changed on account of the shifting of the divide westward. At the time the Weverton peneplain was formed it is not improbable that the divide stood at the present Alleghany Front in Dans Mountain, and possibly even farther eastward for a time. If that interpretation is the correct one the higher and less reduced character of the broad valleys below the Schooley peneplain may find an adequate explanation.

The Weverton peneplain, like the Schooley peneplain, is closely associated with the geology, remnants of the ancient surface being represented, as in the case of the Schooley peneplain, by level-topped sandstone ridges, frequently less fully consolidated in central Allegany County than those representing the older surface.

HARRISBURG PENEPLAIN.—The Harrisburg peneplain, which is found well developed in the western Piedmont Plateau in the Potomac Valley and throughout the Monocacy Valley at an elevation of about 500 feet, is observed in the Great Valley at about 600 feet, where it forms the tops of the low hills that rise above the lowlands of the valley. Throughout western Washington County this plain gradually rises to 700 feet in the district to the north of Indian Springs and to 800 feet to the west of Hancock in the broad lowland lying along the eastern flank of Sideling Hill. Farther west between Green Ridge and Polish Mountain the Harrisburg peneplain is well developed over an extensive area at an elevation of 900 feet. This region furnishes perhaps the largest tract of the-but-slightly-dissected Harrisburg peneplain of any portion of the Appalachian district. Still farther westward remnants of the Harrisburg plain are found in the broad valley between Iron Ore Ridge and Martin Mountain at a height of 1200 feet. Beyond this remnants of the plain are observed in Shriver Ridge at an elevation of about 1500 feet. To this plain may also belong the ridge lying to the west of Wills Mountain although this may well have been formed under different conditions as previously explained.

Somerville Peneplain.—The Somerville peneplain which has an elevation of somewhat over 450 feet in the western portion of the Piedmont district gradually rises to the westward, having an elevation of about 500 feet in the Great Valley adjacent to the Potomac River from the valley of which it slopes gradually northward toward the Pennsylvania line. Farther westward the Somerville plain slowly rises through Washington County, reaching an elevation of about 600 feet to the west of Hancock. In eastern Allegany County it has an elevation of about 700 feet, beyond which it rises somewhat more rapidly, as in the case of the Harrisburg peneplain, to 800 feet along the Potomac River in the central part of the county. From here it rises along the tributaries of the Potomac to the northward and also along the main stream westward to somewhat over 1200 feet to the north and northeast of Cumberland. The Somerville peneplain is very well shown at a large number of points throughout the Appalachian district in the Potomac Valley but gradually disappears up the valleys of the various tributaries.

STREAM VALLEYS.

The present valleys have trenched the peneplain surfaces to greater or less depths. Along the Potomac the trenching was mainly post-Somerville, but up the tributaries, where the Somerville peneplain gradually disappears, the trenching was in part produced at the time of the formation of the Somerville peneplain itself and in some instances represents an even longer period of cutting.

The streams are to a considerable extent adjusted to the present structure, producing what has been described as a trellis or grape-vine system. At times wind-gaps are found cutting the crests of the mountains and representing the location of the streams across the hard rocks before they had been tapped by the tributary of some larger stream flowing along the softer beds, generally in a direction at right angles to the original system.

At the point where the streams cross the hard sandstone ridges deep gorges result, but in the softer beds the channels are frequently wider, with low banks on either side.

ECONOMIC PHYSIOGRAPHY OF THE APPALACHIAN REGION.

LINES OF COMMUNICATION.—The obstacles offered by the successive parallel ridges of the Appalachian province delayed the westward movement of the population in colonial days and restricted the east and west lines of travel to the valleys of the Potomac, the Susquehanna, and the James. The earliest inhabitants found these natural highways already selected as the lines of communication between the distant parts of the great Indian Confederacy, and accepted the experience of the aborigines by building their roads along the same lines.

As the population of the western portions of the State increased, the demand for more perfect highways became urgent, so that before the end of the eighteenth century several well-defined lines of travel had been established between the tidewater regions along the Atlantic and the Ohio drainage. The Cumberland road extended from Washington to Cumberland via Hagerstown and Hancock, and thus followed the line of easiest travel along the valley and across the divides at their lowest points. Beyond Cumberland the road was extended across Big Savage Mountain and the Alleghany Plateau, keeping on the divide between the Potomac and Youghiogheny until it entered the valley of the latter,

Fig. 1.—View of Cumberland showing the Narrows of Wills Mountain, Allegany County.

Fig. 2.—View of the Valley of Monroe Run cut in the Old Peneplain, Garrett County.

VIEWS OF APPALACHIAN SCENERY.

which it followed to the Monongahela, and thence down stream to Pittsburg.

Later the promoters of the Chesapeake and Ohio Canal gained the right of way up the Potomac Valley which is followed to Cumberland. The course of the Potomac at Harpers Ferry and Point of Rocks offered the easiest means of communication across the Blue Ridge district, and when once occupied the Chesapeake and Ohio Canal effectually stopped the westward progress of the Baltimore and Ohio Railroad along the same route until a compromise was effected in 1832. West of Cumberland the railroads crossing the State follow the valleys of the rivers, utilizing the courses of the Potomac River, Wills Creek, Georges Creek, Jennings Run, the Savage River, and the Youghiogheny River.

NATURAL RESOURCES.—The resources of the Appalachians are varied and valuable. The early settlers found the mountains clothed with dense forests of pine and hard wood, but they lacked the means for transporting the lumber to a ready market. Even now with a canal and several railroads the cost of hauling from the forest to the point of shipment is so great as seriously to reduce the profits of the lumbering trade.

The many varieties of soils in the Appalachians are closely related to the geological formations, and their distribution is clearly influenced by the geological structure. Since most of the higher hills and sharp ridges are due to the presence of heavy beds of silicious sandstone, the soils of the upper slopes are generally sandy and poor. Beneath these strata come beds of shales which are sometimes calcareous, so that the lower slopes, hills, and *subsequent* valleys contain soils which, while somewhat stony, give fair yields in wheat, corn, etc.

The Great Valley, with its rich limestone soil and easy means of access from the north and south, forms a broad band of the most fertile lands in the State. If it had not been for the re-elevation of the Shenandoah plain this district would be most favorable to farming. As it is, the rolling surface and steep valley slopes are somewhat difficult to till with ease. The land is so rich, however, that the whole stretch of the valley is or might be under cultivation.

Georges Creek Valley, near Barton, Allegany County.

VIEW OF APPALACHIAN SCENERY.

The chief sources of mineral wealth in the province are the deposits of coal, iron, and cement rock. The coal beds are the remnants of larger areas preserved by their depression below the limits of erosion during the formation of the Schooley peneplain. They have proved of inestimable value to the citizens of the State. The Clinton iron ores were formerly very valuable, but in the present state of the iron market they are of relatively little importance. The cement rock is obtained from certain portions of the Silurian limestones and is the basis of a growing industry. The exposures are favorably situated along the lines of travel, so that the mills have every advantage for the shipment of their product.

INHABITANTS.—The physiography, industries, and resources of the Appalachain province have strongly influenced the character and occupation of the inhabitants, who may be grouped into several well-marked classes. In the higher, more rugged and less populated portions of the area are the mountaineers, who gain their livelihood by lumbering and desultory farming. Gathered about the rich deposits of coal, iron ore, and cement are miners, who are occupied almost exclusively in the extraction of wealth from the underlying rocks. They present a class of marked characteristics in education, training, religion, and nationality. The valleys between the mountains, especially the Great Valley, and the larger, more level areas of the glades, furnish incentive and opportunity for farming communities, which are reasonably well recompensed for their efforts in the tilling of the soil. In the cities and large towns are concentrated those who serve as distributing agents for the products of the land and the necessities of the inhabitants.

GEOLOGY.

The geology of Maryland, as well as its physiography, shows an intimate relationship to the adjacent areas upon the north and south, so that its complete interpretation can be gained only by taking into consideration the great eastern border region of which the State is not only geographically, but geologically a part. Frequent reference will, therefore, be made in the succeeding pages to the general distribution and relations of the geological formations found represented within the limits of the State, although the detailed descriptions will be confined to those features more particularly characteristic of the Maryland area.

The State of Maryland is so situated as to display, in spite of its comparatively small size, less than 10,000 square miles of land area, a remarkable sequence of geological formations. The most ancient rocks which made up the earth's crust as well as those still in the process of deposition are here found, while between these wide limits there is hardly an important geological epoch which is not represented. It is doubtful whether any other State in the Union contains as full a history of the earth's past. To make the completeness of this record in Maryland somewhat more intelligible it is well to consider the basis on which geologists are able to determine the succession of deposits.

Geology in its broadest aspects must be regarded as the science of the earth from its earliest beginnings down to the present day, and as such stands in close relationship to the science of astronomy in its study of the origin of the solar system. In the absence of any other satisfactory theory, most geologists to-day accept the nebular hypothesis of Kant and Laplace to explain the evolution of the solar system. According to this hypothesis, the solar system was developed from a mass of nebulous matter, which extended far beyond the present orbit of the most distant planet, and was rotating slowly in the direction in which the planets now rotate. As a result of rotation this mass gradually contracted and increased its speed of rotation. It was formerly thought that successive rings were thrown off which broke and contracted into the present planets; but by analogy with the many nebulæ which have become known in the last fifty years, it is now thought more probable that the planets originated in special points of condensation of the nebula. Comparisons of the spectra of the comets and nebulæ with those of meteors led Sir Norman Lockyer to the view that these bodies were made up of swarms of meteors whose temperature was raised by impact among themselves; and he contended that the solar system had its origin in such a swarm. Prof. George H. Darwin showed that such a swarm would probably act practically like a mass of gas and that the solar system under this hypothesis would develop in exactly the same way as under the hypothesis of a gaseous origin, a high temperature being caused by the impact of the meteors analogous to that produced by the contraction of the gas. This modification of the nebular hypothesis does not require any material change in the history of the solar system. As contraction and condensation proceeded, the ancestors of the planets became hotter and hotter, and finally reached a stage like that of our present sun; as they became still denser, their power of condensation diminished, and their comparatively small masses have allowed them to cool sufficiently to become solid, though the immense sun still retains enough heat to keep it in a gaseous or liquid state. In the case of the earth, as it continued to cool it is probable that the solid rock first formed at the surface, but on account of its greater density, sank through the underlying liquid, and gradually built up a solid foundation from the center to the surface. The very small conductivity of rock for heat has only allowed a very thin shell of the earth near the surface to cool appreciably below the temperature at which it first solidified. This view has been largely strengthened by the calculations of Lord Kelvin, who assuming that heat had not been developed within the earth since its solidification in sufficient quantities materially to alter the temperature gradiant near the surface, showed that the well-known increase of temperature underground could only be accounted for on the supposition that the earth was at one time hot enough to be liquid. Within a few years Prof. T. C. Chamberlin has advanced the suggestion that the earth was built up by the accumulation of meteors which fell at such a slow rate that the heat of impact was dissipated *pari passu,* and that the internal heat of the earth is due to the compression of the earth under the weight of its own parts. Still more recently, Prof. E. Rutherford has suggested that the internal heat is produced by the radium distributed throughout the earth. The last two hypotheses deny the assumption which is the basis of Lord Kelvin's calculation, and thus cast discredit on the resulting age of the earth; but under any hypothesis we are forced to believe that many millions of years have passed since life first appeared on the earth. We get still further conception of the vast lapses of time which these carly rocks imply, when we discover that, even after the waters had become suited for living beings, a greater part of the development and differentiation of organic life went on in forms which have left no trace of their existence. Hardly a more remarkable fact confronts us in geology than the variety and the complexity of types in the earliest rocks which contain any trace of life at all. The fact, which is all the more remarkable for being attested by the best evidence from all parts of the earth's surface, compels us to assign to the history of life before its first permanent record was made, a longer period perhaps than all the time that has since elapsed, unless the view more recently advanced that acceleration of development took place in the case of the earliest sea floor-dwellers is shown to be true. The earliest forms were either unsuited for preservation or else they have been obliterated in the subsequent alteration of the rocks containing them.

All of the oldest rocks which are to-day entirely without, or with only slight traces of former life, are referred to the first great division of geological history called "Archean Time." These oldest rocks are largely crystalline in character, so that there can be but little chance of encountering organic forms, even had they earlier existed in the strata. Even the least altered deposits, although they have afforded a few scattered remains of archaic forms at certain points, contain nothing more than the merest traces of the organisms of this early time.

When, however, life does once appear in all its variety, it is well nigh the same in all the older rocks. In the most widely separated localities the same types recur in rocks of the same age, and this furnishes us with the key to the succession of deposits. From the time when the oldest fossil-bearing stratum was deposited until now, the story of life-progress and development is told by the rocks with sufficient clearness to be unmistakable. Local differences of conditions have probably always prevailed, as they do now, but the same types of organisms have always lived at the same time over the entire globe, so their remains serve as sufficient criteria for the correlation of the strata which contains them. The sequence of life-forms once made out gives us, for the whole earth, the means for fixing the order of deposits even when this is most profoundly disarranged by foldings of the strata into mountains or by other earth movements.

Geologists distinguish three principal divisions in the history of life as read in the record of the rocks. During the earliest of these great time-divisions, archaic forms of life flourished—uncouth fishes, crustaceans, mollusks, and tree-ferns—most of them very unlike those now extant. On this account this is known as the period of most ancient life or *Paleozoic Time.* To this succeeded a long lapse of ages when enormous reptiles predominated, associated with other types more like those that now inhabit the globe. To this is given the name of middle life or *Mesozoic Time.* Finally living things began to assume the form and appearance with which we are familiar, so that this last grand time-division, which includes the present, is designated as the period of recent life or *Cenozoic Time.*

Each of these three grand divisions of geologic time is in its turn separated into shorter subdivisions called *Periods,* characterized by their own peculiar types of life; and the several periods themselves are divided into *Epochs,* which vary more or less in character according to the region where they are developed. For this reason the chronological and stratigraphical divisions require an independent nomenclature, although this duality of geological classification can in most instances be readily adjusted to the contingencies of each district. The stratigraphical divisions are usually designated by local terms.

In Maryland we have representatives not merely of the great time-divisions, but of each subordinate period, as well as of many of the epochs. This may be best appreciated by referring to the accompanying geological map and to the table of geological formations which follows.

TABLE OF MARYLAND FORMATIONS.

SEDIMENTARY ROCKS.

Cenozoic.		
Quaternary.		
Recent.		
Pleistocene	Talbot	
	Wicomico	= Columbia Group.
	Sunderland	
Tertiary.		
Pliocene	Lafayette.	
Miocene	St. Mary's	
	Choptank	= Chesapeake Group.
	Calvert	
Eocene	Nanjemoy	= Pamunkey Group.
	Aquia	
Mesozoic.		
Cretaceous.		
Upper Cretaceous	Rancocas.	
	Monmouth.	
	Matawan.	
	Magothy.	
Lower Cretaceous	Raritan	
	Patapsco	
Jurassic (?)		= Potomac Group.
Upper Jurassic (?)	Arundel	
	Patuxent	
Triassic	Newark.	
Paleozoic.		
Permian	Dunkard	
Carboniferous.		
Pennsylvanian	Monongahela	= Coal Measures.
	Conemaugh	
	Allegheny	
	Pottsville	
Mississippian	Mauch Chunk.	
	Greenbrier.	
	Pocono.	

Devonian.		
Upper Devonian	Hampshire.	
	Jennings.	
	Chemung.	
	Portage.	
	Genesee.	
Middle Devonian	Romney.	
	Hamilton.	
	Marcellus.	
Lower Devonian	Oriskany.	
	Helderberg.	
	Becraft.	
	New Scotland.	
	Coeymans.	
Silurian	Cayugan.	
	Manlius.	
	Salina.	
	Niagara.	
	Clinton.	
	Tuscarora.	
	Juniata.	
Ordovician	Martinsburg	? Peachbottom slate. Cardiff quartzite. Wissahickon phyllite and schist.
Cambrian	Shenandoah (upper part)	? Cockeysville marble.
	Shenandoah (lower part)	
	Antietam	? Setters quartzite and mica schist.
	Harpers	
	Weverton	
	Loudon	
Archean.		
Algonkian	Baltimore gneiss (in part).	

IGNEOUS ROCKS.

Mesozoic.	
Triassic	Diabase.
Paleozoic-Archean	Pegmatite.
	Peridotite, pyroxenite, and serpentine.
	Basic volcanics—Meta-andesite, meta-basalt.
	Acid volcanics—Meta-rhyolite.
	Granites.
	Gabbro, norite, meta-gabbro.
	Baltimore gneiss (in part).

As has been pointed out in the physiographic description of the State, Maryland's territory falls naturally into three sharply contrasted provinces: an eastern coastal plain bordering the Atlantic Ocean and surrounding the Chesapeake Bay; a central plateau; and a western region of mountains. These three main physiographic divisions were found capable of further differentiation into seven topographic belts, and these seven subordinate regions are each composed of a distinct series of geological formations. This may be perceived readily by examining the geological map.

The separateness of the formations is less pronounced in the two divisions of the Coastal Plain, although the northeast-southwest trend of the nearly horizontal beds produces a predominance of the later Cenozoic formations on the Eastern Shore and of the Mesozoic and early Cenozoic deposits on the Western Shore.

In the Piedmont Plateau the twofold character of the province is more marked geologically. On the eastern side of Parrs Ridge the ancient sediments are highly metamorphosed by a development of new textures and minerals due to the recrystallization of the material under great pressure. This division is also marked by the presence of large masses of granular igneous rock which consolidated at great depths beneath the surface of the earth. On the western side of the median ridge the sediments are less metamorphosed and less thoroughly recrystallized although their original textures have been more or less obliterated. There is also marked lack of deep-seated igneous rocks which are here represented by smaller masses of surface volcanics, both acid and basic, which have been less thoroughly recrystallized than their analogues in the eastern district. Along the western border of this western district, between the Monocacy and the mountains, the early Paleozoics have only slightly changed, the blue limestones of the Frederick Valley resembling the contemporaneous limestones of the Hagerstown Valley farther west. Immediately east of the mountains the earlier rocks are covered with the slightly inclined unmetamorphosed red and gray sandstones and conglomerates of Mesozoic age and intruded by the diabase dikes of the same period.

The threefold division of the Appalachian Region corresponds approximately to the threefold division in the sequence of the Paleozoic strata. The Blue Ridge and Great Valley are made up largely of Cambrian and Ordovician beds, in places so developed or eroded as to expose the associated igneous rocks; the Appalachian Mountains proper are made up of sharply folded Silurian and Devonian strata, each easily recognized by the characteristic life-forms; while the Alleghany Plateau is mainly composed of more gently folded later Devonian and Carboniferous deposits, carrying the valuable coal seams of the Cumberland basin.

Such, in brief, is the distribution of the geologic formations in Maryland and their connection with the easily recognized types of surface configuration occurring within the State. The sequence is of remarkable completeness and of great interest on account of the many types of topography and soils which the various formations produce. In the succeeding pages the geological history of each of the three provinces—plateau, mountains, and coast plain—will be traced out in more detail. A somewhat different sequence will be followed than in the preceding physiographic sketch, the Piedmont Plateau being considered first, as it is the oldest, and then in order the Appalachian Region, which is next in age, and finally the Coastal Plain, which is the youngest portion of the State. Constant reference to the geological map will be found of service in following the descriptions which will be given.

THE PIEDMONT PLATEAU.

A clear understanding of the various formations found within the limits of the Maryland portion of the Piedmont Plateau can only be gained through a consideration of the conditions present throughout the great Piedmont area of eastern North America, which, as already described, is well recognized as a broad upland lying at the eastern slope of the Blue Ridge, extending from Alabama northward as far as New York. Throughout this region are exposed numerous highly crystalline gneisses and schists associated with crystalline limestone, quartzites, and igneous rocks here and there covered by Triassic shales and sandstones. Northward from New York the physiographic unity of the

Piedmont Plateau is less evident but the same highly crystalline rocks may be traced across New England to the Maritime Provinces of Canada. Within this whole province the rocks are so crystalline as to make fossils rare, while their structure presents some of the most puzzling problems in American geology.

The deciphering of the various formations occurring within the Piedmont is still in progress and many areas are yet unstudied, but the areal distribution of the various deposits throughout the territory north of Virginia has been determined with sufficient accuracy to indicate the various types of rock present.

STRUCTURAL RELATIONS OF THE PIEDMONT FORMATIONS.

A knowledge of the character of the major structures along the eastern Atlantic coast from New Jersey southward and the position of the Maryland deposits with respect to these structures is also necessary for a proper understanding of the structural relations of the Piedmont deposits of Maryland. The facts given below are familiar to students of American geology, but it seems desirable to restate them in relation to the Piedmont rocks under discussion.

Among the more striking features of the continental structure along the eastern coast of the continent is the generally northeasterly trend of the folds in the rocks constituting the Appalachians. This structure holds for most of the territory from Alabama to Maryland and from New York City northward to the Canadian boundary. In the regions of Maryland and Pennsylvania, however, there is a marked deflection of these parallel folds, with the result that they are found to trend in Pennsylvania almost due east and west from the Maryland line to the Delaware. Beyond the Delaware the formations gradually resume their northerly trend.

Starting on the west with the faulted and sharply folded anticlines of the Blue Ridge, bordered on either side by Cambrian rocks and associated igneous masses, one may pass successively eastward through Maryland across the gently eastward sloping limestones of the Frederick Valley, which in turn, appear to dip under the so-called semi-crystallines or phyllites of the Piedmont. Between the eastern limits of the limestones and the western boundary of the marbles of the eastern division of the Maryland Piedmont, in Frederick, Howard, and Carroll counties, is an area which needs more study before its structure can be adequately described. Preliminary work has, however, shown a vast mass of more or less metamorphosed rocks including old volcanics, both acid and basic, gneisses and schists, limestones and phyllites which are similar to the rocks of the eastern division of the Piedmont. These various rocks show the same order of occurrence, but the manner in which this sequence is repeated again and again has not yet been deciphered. While the detailed structure is not fully known, it seems probable that there exists in this part of the State a very open general structure by which the beds lie almost horizontal in their major folds, with a much compressed and occasionally overturned subordinate structure, which, because of the numerous minor folds, give to the rocks an appearance of highly inclined and complicated folding.

East of Parrs Ridge the rocks are more crystalline and the folding is a little more pronounced in its general features, with a change in the strike of the axes of the major folds in conformity with the change of direction in the continental folding previously described. Between the area of more open folding, just mentioned, on the northwest and the cover of Coastal Plain deposits on the southeast one may readily recognize in the Maryland area the broad synclinal trough of the eastern phyllite belt and that of the Cockeysville marble, separated by a dome-like anticline of the Baltimore gneiss extending approximately from Reisterstown to Jarrettsville. Still farther east, separated from the Cockeysville synclinorium in part by a southern anticlinal border of Baltimore gneiss, is a broad zone of igneous rocks composed of gabbros, granites, and other plutonic types which occupy most of the eastern border of the Piedmont between Wilmington, Delaware, and Laurel, Maryland.

Minor igneous masses are found with the same general trend, and these are seen to be rather closely associated with the structure lines of the region, occupying as they generally do anticlinal axes. This relation to the structure lines is particularly well shown in the case of the long belt of serpentines extending from Lancaster County, Pennsylvania, across the Susquehanna River almost to the nose of the northern anticline of the Baltimore gneiss. Farther to the southwest, almost on the strike of this anticlinal axis, begins a long and somewhat narrow body of granite extending from Sykesville, on the Baltimore and Ohio Railroad, southward past Washington and thence continuing probably as far as the region about Fredericksburg, Virginia.

METAMORPHISM.

The older rocks of the Piedmont have suffered more or less recrystallization and textural modification since their formation. This metamorphism has not been uniformly distributed over the entire region, but is much accentuated in the eastern portion of the Maryland area, where the rocks are thoroughly recrystallized and often lack in great measure their original textures. The original clays and sands of the sedimentaries have been changed to micaceous schists, gneisses, and quartzites and the various igneous rocks have been greatly modified in texture and occasionally in mineralogical composition. The textural change which is most evident is a marked development of lamination or schistosity which is to be noticed in all of the rock types. The change from massive to schistose rocks has not been uniform over the entire district or even over the more metamorphosed eastern section, but seems to be locally accentuated along lines which probably indicate zones of greater dynamic action.

The schistosity developed in the rocks of the Piedmont partakes of the general northeast-southwest trend of the province and varies in dip, sometimes to the eastward and sometimes to the westward. It is present in both the sedimentary and igneous rocks. In the latter, it is sometimes so strongly developed that the resulting rocks, in small areas, present the appearance of metamorphosed sediments, although one may find all gradations between the unaltered massive types and the equivalent fissile schists. In the sedimentary rocks the schistosity is developed to a degree which greatly obscures the original bedding and oftentimes renders the determination of bedding-planes impossible.

The development of schistosity is accompanied by a recrystallization of the affected rocks, which may simply result in a new development of the mineral species found in the original rock or in a molecular rearrangement producing many new minerals. Thus the gneisses are composed of recrystallized quartz, feldspar, and micaceous material, while the feldspars of some of the granites, the meta-rhyolites, gabbros, and diorites have been changed to epidote, and the pyroxenes to fibrous or compact hornblende. The new minerals usually lie with their longer axes parallel to the planes of schistosity. In the case of the mica-schists, phyllites, and slates the original material has been changed to muscovite, chlorite, and quartz with accessory minerals such as garnet, staurolite, cyanite, etc.

RELATIONS OF THE EASTERN AND WESTERN DISTRICTS OF THE PIEDMONT.

The division of the Piedmont Plateau into an eastern district composed of much metamorphosed, highly crystalline rocks, and a western district characterized by less metamorphosed, so-called "semi-crystalline," rocks has long been recognized but was first sharply emphasized by the late Professor Williams in 1891, who regarded the eastern area as composed of rocks far more ancient than those in the western district and that they extended westward, forming a floor upon which the younger phyllites were deposited. He also believed that the eastern district had already been much folded and metamorphosed before the phyllites had been laid down. As a conclusive argument against the identity of age of the semi-crystalline rocks of the western district and the holocrystalline rocks of the eastern district, he summarized five points which have been much weakened by later more detailed work in the area. There remain, however, many noticeable differences between the rocks of the region about Baltimore and those of Carroll, Howard, and Frederick counties and the division into districts is still retained in the present discussion because of these differences, and also because the amount of knowledge gained by the present Geological Survey is very different in respect to the two districts. The eastern district has been mapped in detail and the facts regarding the geology of this region are now sufficient to determine many of the problems which this exceedingly complex region presents. The western district, on the contrary, because of the lack of suitable maps, is much less completely understood and the statements concerning it must be regarded as based upon much less satisfactory information.

The rocks of the Piedmont of Maryland as a whole, may be divided into several groups, the highly crystalline metamorphic sedimentaries of the eastern district, with their associated igneous rocks, their less altered equivalents of Cambro-Ordovician age in the western district, with their associated volcanic rocks and the much younger sedimentary and igneous rocks of the Mesozoic. The various rocks which are most prominently developed will be more fully discussed in the succeeding pages.

EASTERN DISTRICT.

The rocks of the eastern district of the Piedmont show a clearly established sequence which may also be recognized, in part at least, at many points in the less well-known western district. Similar sequences in rocks of known age are recognized at many points in the Piedmont areas of adjoining states and, while there are yet many unexplained difficulties, the assignments of geological age given in the accompanying table appear to be those most in harmony with all the facts now at hand.

FORMATIONS OF THE EASTERN PIEDMONT PLATEAU.

SEDIMENTARY ROCKS.

Paleozoic.	
Ordovician (?)	Peachbottom slate.
	Cardiff quartzite.
	Wissahickon phyllites and schists.
Cambro-Ordovician (?)	Cockeysville marble.
Cambrian (?)	Setters quartzite and mica schist.
Archean.	
Archean or Algonkian (?)	Baltimore gneiss (in part).

IGNEOUS ROCKS.

Mesozoic.	
Triassic	Diabase.
Paleozoic Archean	Acid volcanics (meta-rhyolite).
	Pegmatite.
	Peridotite, pyroxenite, and serpentine.
	Granites.
	Gabbro, norite, and meta-gabbro.
	Baltimore gneiss (in part).

Highly Metamorphosed Sedimentary Rocks.

The rocks lying east of Parrs Ridge and forming the eastern district of the Piedmont, with the exception of a few dikes of Mesozoic diabase, consist of metamorphosed sediments, and a diversified complex of intruded igneous rocks which have themselves been more or less metamorphosed from their original massive condition to schistose or laminated rocks. Each of the metamorphosed formations, beginning with the oldest, will be discussed in turn and then the various igneous rocks which represent one or more periods of igneous activity in a common parent magma.

THE BALTIMORE GNEISS.—The oldest formation in Maryland is the Baltimore gneiss, which occurs in several well-defined areas between the Susquehanna and Potomac rivers. The easternmost of these Baltimore gneiss occurrences is within the area of Cecil County, east of the Susquehanna River, and extends from this point southwestward, widening to an area of five miles or more in breadth where it is overlain by Coastal Plain deposits in Harford County. This formation is limited on either side by igneous rocks. A northern outlier a mile or less in width extending for several miles southwestward from the Susquehanna River probably represents a detached portion of this larger mass lying a little to the south.

The second area of Baltimore gneiss is found in an anticlinal dome, 15 miles long and 5 miles broad, lying on either side of the Northern Central Railroad 10 miles south of the Mason and Dixon Line and 20 miles north of Baltimore. Three smaller areas occur in the vicinity of

Baltimore. Two of them are portions of anticlinal domes which are either completely enclosed by overlying sediments or cut off by faults and igneous rocks, while the third, underlying the northwestern part of Baltimore City, is entirely surrounded by gabbro and other igneous masses and is overlain in great measure by the Coastal Plain deposits.

The rocks in each of these areas consist of highly crystalline gneisses composed of quartz, feldspar, and mica, with accessory minerals, which are so distributed as to produce well-marked, gray banded-gneisses, the individual bands of which vary from a fraction of an inch to several feet, the average thickness, however, being quite slight. Some of these bands are highly quartzose, resembling a micaceous quartzite; others are rich in biotite or hornblende, producing dark schists, which in a hand specimen are indistinguishable from metamorphosed igneous masses. Within the areas of Baltimore gneiss are also numerous small bodies of metamorphosed granites and more basic igneous rocks, which have been intruded into the gneiss and subsequently metamorphosed until they are practically indistinguishable from it. The differences in character can now and then be recognized, but it has not been found possible to carry the mapping of these small igneous intrusions from one exposure to another.

Sometimes separated by an appreciable unconformity and at other times separated by no apparent line, the Baltimore gneiss, unless bounded by igneous rocks or faults, is overlain by the next succeeding formation.

The Setters Quartzite.—The Setters quartzite occurs usually as a narrow rim on the flanks of the areas of Baltimore gneiss, but is not continuous or always present. Thus in the easternmost areas of Baltimore gneiss previously described no Setters quartzite is recognized. It is found, however, skirting the anticlinal dome of Baltimore gneiss in northern Baltimore County, where it occurs as a single band on the eastern end of the dome and as a series of somewhat parallel ridges on the northwestern slope of the anticline, where the contact between the underlying gneiss and the quartzite is near the present surface of the country. On the southern slopes of the dome the quartzite is frequently lacking along the western half, but is found in varying thickness along the eastern part of the anticline. The quartzite also occurs in the smaller anticline about a granite mass in the vicinity of Warren, just south of the previously described anticlinal dome.

Quartzite in Setters Ridge occurs as a continuous belt about the small anticlinal dome lying 10 miles northwest of Baltimore between the Northern Central and Western Maryland railroads. The formation here is of rather uniform thickness and stands at a steep, sometimes overturned, angle on the flanks of the gneiss. Across the valley of Lake Roland is a similar, though less well-defined, anticlinal arch of more complicated structure, along the side of which may be seen the Setters quartzite, extending from the Northern Central Railroad on the west, eastward as far as the nose of the anticline at Glenarm, where it passes under the overlying formations, or is cut off by igneous rocks.

On the western side of the Baltimore area, extending southward through Howard County, may be found occasional exposures of Setters quartzite between the gneiss and the marble. The work in this area has not been completed, but it seems quite probable that the quartzite will be found developed as a more or less continuous stratum lying between the Baltimore gneiss on the east and the overlying marble on the west, as it has already been recognized in this position at many points.

The quartzite is a fine-grained, somewhat saccharoidal, thin-bedded rock of white or cream color in its typical development along Setters Ridge. At this point the beds are usually separated by thin films of muscovite or sericite in small sparkling flakes. On the surface between the individual beds are black tourmalines, which have been more or less disturbed, as is shown by the stretching which they have undergone. The Setters quartzite as a formation is, however, somewhat more variable than was at first supposed from the study of the original locality on the south side of Green Spring Valley. Locally, the rock may become very vitreous and massive. At other times, it becomes more argillaceous, with a development of garnets, staurolite, and other accessory minerals. The development of such minerals causes this quartzite formation to simulate in lithologic character the overlying Wissahickon mica-schist, and at times occasions considerable confusion. The more quartzose layers may be intimately interbedded with the more micaceous and garnetiferous ones toward the center of the formation, and the upper portion of the formation when well developed may be highly micaceous and garnetiferous. The development of this micaceous phase of the Setters formation is especially marked along the valley at Stringtown, in the northeastern extension of the limestone valley near Glenarm, and in the small anticline at Warren, especially near the mouth of Royston Branch. In all of these instances the micaceous member of the quartzite is seen to *underlie* the marble and to overlie or to be interbedded with the more quartzose phases of the Setters formation.

The Cockeysville Marble.—The maximum development of the Cockeysville marble is found in the synclinorium lying between the anticlines of Baltimore gneiss and quartzite about 10 miles north of Baltimore City, and on the flanks of the anticlinal dome northeast of Reisterstown. It is here found underlying the Wissahickon mica-schist, and overlying the quartzite, the various formations recurring at the surface through numerous foldings, the contact between the marble and the adjacent formations lying very close to the present surface of the country. Southwest from these larger areas of Cockeysville marble the formation may be traced with little or no interruption in well-defined valleys to the vicinity of Clarksville, in Howard County. The details regarding the southwestern exposure of the Cockeysville marble are not all worked out, and it seems quite probable, from the facts at hand, that there is a fault striking northwest and southeast and extending southeastward to a point near Laurel.

The marble occurring in these areas is in the majority of instances rich in magnesium and should be called a dolomite. This is particularly true at the type locality, Cockeysville, but there are frequent changes in the amount of magnesium present, and one often finds magnesium-free, or magnesium-poor rocks in proximity to the dolomitic varieties. The changes in composition are sharp and generally easily recognized by the quarrymen, who are assisted by the fact that the dolomitic marble averages finer grained and richer in magnesium-mica than the better-burning, magnesium-poor rocks. Attempts have been made by acid tests in the field to recognize some stratigraphic distribution of the magnesium and calcium-rich rocks, but these have failed. On the contrary, it has been found that there are rapid, sharp alterations of the two types in a way which strongly suggests that whatever dolomitization occurred must have taken place prior to emergence from the sea and probably contemporaneously with the formation of the deposit. No fossils have been found in the marbles, and as they are highly crystalline, it is very doubtful if any will be found.

THE WISSAHICKON PHYLLITES AND SCHISTS.—The position which this formation holds in the stratigraphic sequence of rocks appears very clear in the district under discussion, where in each instance it is apparently younger than the marble and consequently younger than both the Setters quartzite and the Baltimore gneiss. In contiguous areas there are phenomena which suggest that this is not the true sequence and that this formation is really older even than the Baltimore gneiss. Until this suggested abnormal sequence can be established beyond reasonable doubt, it seems wiser to hold to the relations which the Maryland area suggests. The difficulty arises from two facts regarding the Wissahickon formation as recognized in Maryland. The first is that while the apparently older marbles and quartzites show few intruded igneous masses, the more crystalline phases of the Wissahickon show them in abundance. This is contrary to what might be expected but is, of course, a possible circumstance. The second difficulty arises from the occurrence of highly crystalline garnet-mica-schists and gneisses and less crystalline chlorite and sericite schists. The line of separation between these two phases may be drawn but the gradual change from one phase to the other is more indicative of a gradation than of a fault such as would be required if these rocks are older than the Baltimore gneiss; and the frequently crenulated line of the contact, as found by Keith in Howard and Carroll counties, also points to the adopted relationship.

The more crystalline garnet-mica gneisses and schists of the Wissahickon lie east of the broad phyllite, or less crystalline phase, which extends southwestward from the Susquehanna River to southeastern Carroll County. The formation in this part of its development broadens

Fig. 1.—Granite Quarry near Woodstock, Baltimore County.

Fig. 2.—Contorted Schist above Bald Friar, Cecil County.

VIEWS SHOWING GEOLOGICAL FORMATIONS OF THE PIEDMONT PLATEAU.

from a narrow band at the Susquehanna River by increased folding about the anticlines of Baltimore gneiss and synclines of Cockeysville marble into a belt 10 to 15 miles broad as it crosses the Northern Central Railroad. From this point it narrows somewhat to the southwestward, and the area is occupied in large part by the large mass of granite passing from Sykesville southwestward to Washington and extending thence many miles southward into Virginia.

North of the phyllite occurs a corresponding mass of the more crystalline Wissahickon schist. When, however, this is compared with the rocks of the southern limb of the synclinorium, it is found that these rocks average slightly less crystalline and less metamorphosed than the corresponding rocks on the south. There is also a corresponding lack of deep-seated igneous rocks. That they represent the same horizon seems to be well established by the areal distribution of the various masses, although it has been found impossible to carry the mapping of individual beds more than a few miles along the strike, and hence it has seemed inadvisable to attempt detailed representation on the maps. The Wissahickon schists on the west side of the syncline of phyllites passes southwesterly across the State, narrowing considerably in the southern portion of Carroll County and widening somewhat in passing southward to the Potomac River.

The areal distribution of the Wissahickon suggests an increased crystallinity eastward and decreasing crystallinity westward. To the eastward are the deeper igneous rocks in large masses, on the west smaller areas of surface volcanics. It remains to be seen whether the occurrence of the more crystalline phases with deep-seated igneous rocks is the cause of the increased crystallinity or not.

The band of *phyllite,* sericitic, and chloritic schists forming a synclinal trough extending from the Susquehanna southward, enters the State from York County, Pennsylvania, continues as a belt, varying from 5 miles in breadth at the Susquehanna to about a mile at Whitehall, on the Northern Central Railroad, whence it gradually widens southward to an average breadth of 3 miles in the southern part of Carroll County. The areal distribution indicates a synclinal trough of considerable extent and well-defined character, which is warped at its center, and plunging northeastward and southwestward and reaching its maximum depth in the vicinity of Delta, Pennsylvania, where the Cardiff quartzite-conglomerate and Peachbottom slates are found folded within it. The southern termination of this phyllite belt has not been mapped in detail and the limits given on the geological map are provisional.

The rocks constituting the phyllite portion of the Wissahickon formation are essentially sericitic, chloritic, and occasionally talcose schists, which clearly show their sedimentary origin, and have been less metamorphosed than the Wissahickon schists already described. Two views are held regarding their relations to the contiguous formation. They may be regarded as an infolded considerably younger series, as held by the late Professor Williams, or they may represent a less metamorphosed upper portion of the Wissahickon formation. It seems probable that there is truth in both views, and during recent years the impression has developed that in Maryland they represent the upper portion of the Wissahickon formation, which has been less metamorphosed, but that they are not separated by any great interval from the more crystalline Wissahickon schists which border them on either side, and from which they cannot be separated by any sharp line.

When crossing the boundary between the two formations one may recognize within comparatively short distances that a boundary has been passed, but up to the present no sharp contacts between the two portions of the Wissahickon formation have been found.[1]

The Cardiff Quartzite.—The Cardiff quartzite and quartzose conglomerate occur as a small and rather insignificant formation in the northeastern part of Harford County. They form a narrow band apparently resting on the phyllite and underlying the Peachbottom slate,

[1] The interpretation of the phyllites here discussed does not necessarily or even probably apply to the more extensively developed phyllites of the western district, though some of the latter may be equivalent to the phyllites of the eastern district. Nor does it apply in more than a general way to the corresponding Hudson schists of Pennsylvania which are found as a continuation of this belt on the south side of the Chester Valley in Lancaster and Chester counties where the more schistose and less crystalline rocks are found immediately above the limestone.

wrapping around the latter and extending beyond its southwestern limits to the valley of Broad Creek. It is this formation which yields numerous boulders along the base of Slate Ridge. It is seldom well exposed and is of limited extent.

This formation may be represented in Rocky Ridge at the Rocks of Deer Creek, but it has not been possible to establish this point and many facts militate against the probability of such a correlation.

THE PEACHBOTTOM SLATE.—The Peachbottom slates extend as a narrow strip within the limits of the Cardiff quartzite and pass beyond it across the Susquehanna River into Lancaster County, Pennsylvania. This formation is composed entirely of characteristic blue-black slates, similar to the material put on the market, and the homogeneity of the formation is now so complete that it is impossible to perceive within it any succession of sedimentary beds. It is usually considered, however, that the central portion of the ridge differs somewhat from the sides, and that this portion represents the uppermost member in a tightly pinched syncline.

The Peachbottom slates have been somewhat questionably assigned on doubtful fossil evidence to the Hudson River horizon of the Ordovician. It may even be that these slates and the Cardiff quartzite beneath are only local variations in the great mass of phyllites or micaceous and chloritic schists of contiguous areas.

Igneous Rocks.

The metamorphosed sedimentary rocks already described constitute only part of the area of the eastern district of the Maryland Piedmont. Into them have been intruded vast masses of molten material which have consolidated for the most part into two main types, gabbro and granite, with smaller masses of peridotite, pyroxenite, and their alteration product serpentine, allied to the gabbros, and other smaller masses of pegmatite and meta-rhyolite allied to the granite.

The geological period in which these masses were intruded is still somewhat uncertain, depending upon the final determination of the age of the Wissahickon formation, but the manner in which they were formed is rather satisfactorily established to be as follows:

A large reservoir of molten material, slightly more silicious than the gabbro, existed beneath the Piedmont region from New Jersey southward at a great depth below the ancient surface of the earth and much below our present surface. During geologic time this material was gradually separated into masses poorer and richer in silica than the average. The former gradually cooled into what is now gabbro, the latter into our present granite. The process of separation into parts continued producing ultimately the extremely basic peridotites and allied rocks, and the correspondingly highly silicious pegmatites and meta-rhyolites. The gabbroic material was intruded in the then existing rocks in huge masses, one of them extending over much of the territory from Trenton, New Jersey, to Laurel, Maryland. The granitic material consolidating slightly later formed the extensive areas of granite, and still later, toward the end of this igneous activity, the more basic peridotites and pyroxenites were produced, and lastly the highly silicious residue formed pegmatite dikes which are widely scattered over the area in small masses. These rocks consolidated many thousand feet beneath the existing surface, only the meta-rhyolite consolidating near what was then the surface of the country.

Subsequent to the formation of all these rocks the overlying material was removed by the degrading action of the streams, bringing the deeply-buried masses to the surface as they now appear.

The Gabbro, Norite, and Meta-gabbro.—The oldest, as well as the most extensive, of these igneous rocks which intruded the Baltimore gneiss and other existing rocks is the gabbro. There are three main areas of these rocks within the limits of the State—the Stony Forest area of Harford and Cecil counties; the great belt or sheet which extends from the north of Conowingo, on the Susquehanna River, in a south-southwest direction to Baltimore City; and the irregular intrusive area which is mainly developed to the west of Baltimore and extends thence as far south as Laurel.

The gabbro and norite are rather fine-grained aggregates of hypersthene, diallage, plagioclase (bytownite), and magnetite, with varying amounts of apatite and brown hornblende. The unaltered gabbros are usually massive, heavy, and dark colored. With the alteration, the color changes through a pale buff to the characteristic deep, reddish brown. By an increase in magnesia the gabbros pass by transition towards the peridotites and pyroxenites; or in alumina, to highly feldspathic rocks; or in silica, to others which have free silica forming blue grains.

The action of pressure which has caused the recrystallization of the gneiss and marble is also well marked in the gabbros. It has caused the iron constituent, pyroxene, to change to another green mineral hornblende; and has in some cases left the rock as massive as at first, or in other cases rendered it schistose. The resulting rock is called *meta-gabbro* or gabbro-diorite. The change has always been most complete where the mass of gabbro is small, as in the narrow beds which connect the larger areas. This change is well shown along the Belair road near Baltimore and in the Mt. Hope cut of the Western Maryland Railroad.

The gabbro offers great resistance to the ordinary processes of decomposition, and hence its boulders are strewn abundantly all over the area, which it occupies. It is at the same time so hard, so heavy, and so jointed that it could not be quarried to any advantage as a building stone. The loose blocks are much used for constructing stone walls or foundations, and occasionally whole buildings are erected of them. This rock when crushed furnishes one of the best road-metals found in the State.

The Granites.—The second in extent and the first in commercial importance among the igneous rocks of the eastern Maryland Piedmont are the granites. They are found in richest development about Port Deposit and Frenchtown on the Susquehanna River; at Woodstock and Ellicott City on the Patapsco River; at Guilford on one of the branches of the Patuxent River; near Washington on the Potomac; and in the great lenticular area extending northward from the latter point to Sykesville on the main line of the Baltimore and Ohio Railroad. In these areas are active quarries furnishing high-class building stone. Besides these major masses are smaller ones, as at Cockeysville and Franklinville, which have not been developed commercially.

The term granite is here used in its broader and more familiar sense for the large and common group of granular rocks which are usually of a somewhat mottled light gray or pink color and almost always carry two minerals, quartz, and feldspar, as essential constituents. Besides these which constitute the mass of the rock, there are dark colored iron-bearing minerals, such as black mica, or biotite, hornblende, and occasionally pyroxene. Each of these may be distinguished by the eye unaided by the lens, and besides there are many others only recognizable with the aid of the microscope. The term includes rocks technically known as granite, granitite, monzonite, diorite, et cetera.

The areal distribution and economic characteristics of the granites are more fully treated under the discussion of the building stones among the Mineral Resources of the State.

The Peridotite, Pyroxenite, and Serpentine.—The third type of eruptive rocks which penetrated the gneiss complex is younger than the preceding, but genetically allied to the gabbro. These two types are connected by many intermediate varieties; and these more basic rocks, which break through the gabbros as well as through the gneiss, may be regarded as having resulted from the gabbro magma which had become relatively poor in alumina, or in alumina and silica. The absence of alumina would prevent the formation of feldspar, and hence in the first case crystallization produced an aggregate of pyroxene (bronzite and diallage) called *pyroxenite* (websterite); while in the second case an aggregate of olivene and pyroxene with more or less magnetite was the result. This type is called *peridotite* (lherzolite).

The two non-feldspathic types of eruptive rocks, pyroxenite and peridotite, are peculiarly subject to alteration. The pyroxene, when it occurs alone, tends to pass into secondary hornblende, and this in turn gives rise to talc. This is the origin of some of the extensive beds of steatite in eastern Maryland and Virginia. The talc is always mixed with more or less pale fibrous hornblende (tremolite) and chlorite. When, as in the peridotite, olivene accompanies the pyroxene, especially if it is bronzite, the rock tends to form serpentine instead of talc. The serpentine also contains secondary hornblende formed from the diallage.

Both types of non-feldspathic eruptives are very intimately associated.

They usually do not cover large areas, but occur in small lenticular patches. Varieties intermediate between the two extremes are common, so that the two alteration products, steatite and serpentine, are even more intimately mingled than the rocks themselves. These ultra-basic rocks are most abundantly developed in the serpentine area of Harford County which extends southwesterly across a corner of Cecil County from the "State line" serpentine area of Lancaster County to the vicinity of Jarrettsville. Other areas of considerable extent occur northwest of Baltimore, as at Bare Hills and Soldiers Delight, and in Montgomery County in the vicinity of Gaithersburg.

THE PEGMATITE.—The pegmatites, which are coarse-grained aggregates of quartz, feldspar, and occasional accessory rarer minerals, probably represent the last products of the consolidation of the magmatic reservoir from which all the igneous rocks of this region were originally derived. They are the richest in silica, alumina, and the alkalies, poorest in iron and magnesium, and coarsest in grain. These features suggest that they were formed when the residual magma, still highly heated, was scarcely more than an aqueous solution of the constituents which these rocks contain. They fill the cracks due to the contraction of the cooling rocks or orogenic movements, and are found most abundantly along the borders of the other igneous masses. This is especially true for the edges of the serpentine and gabbro masses and on the borders of the granitic areas. They occur irregularly through the rocks and their presence is usually indicated by an abundance of boulders or white chalk-like streaks in the roadside cuttings. They are abundantly developed in the valley of the Patapsco in Baltimore, Howard, and Carroll counties and along the Susquehanna in the vicinity of Castleton and Conowingo; where they are of sufficient size and purity to become of some commercial importance as the source of feldspar and "flint" used in pottery works.

THE ACID VOLCANICS (META-RHYOLITE).—Along the lower Susquehanna gorge in the vicinity of Frenchtown and Havre de Grace are a few dark colored rocks of greenish hue due to their contained epidote. These "greenstones" occur in small dikes cutting the adjoining rocks and may be traced away from the river on either side but especially to the eastward in Cecil County where they are more abundantly developed in the Principio Valley and at "Gilpin Rocks" near Bay View. At first sight, they appear rich in iron-bearing minerals and not unlike the gabbro, but chemical and microscopical analyses show that they are in reality old lavas of the composition of granite, i. e., rhyolites, which have been changed by the vicissitudes to which they were subjected during the long history of earth changes which this region has undergone. They are of little areal importance but are of considerable interest since they represent almost the only evidence of former volcanic activity in the eastern district of Maryland.

The Mesozoic Diabase intrudes all of the older crystalline rocks in a series of dikes that may be traced with occasional interruptions across the entire eastern district of the Piedmont. The first of these series enters Cecil County from Pennsylvania and extends into Harford County. A second series enters the State near the Harford-Baltimore County line and may be traced across the latter county into and across Howard County. The rock is a typical Mesozoic diabase presenting no unusual features. It is seldom well-exposed, the courses of the dikes being marked by deep red soil and dark red or brown rounded boulders of "trap." Occasionally these are sufficiently abundant to warrant their consideration as a source of road metal.

WESTERN DISTRICT.

The rocks of the western district, while much less thoroughly known than are those of the eastern district, show among themselves a sequence which is strikingly in harmony with that discovered in the eastern district. Although the separation into two districts may be either temporary or permanent according to the results of later work, it seems advisable at the present time to retain them and the line is drawn arbitrarily along a geological line traced by Mr. Keith in his work in Montgomery and Frederick counties. On the eastern side of the western district the rocks are scarcely distinguishable from those of the eastern district, but in the western part of the district the rocks are much less metamorphosed. There the limestones of the Frederick Valley and the underlying quartzite of the mountains are indistinguishable from the corresponding rocks on the western side of the Blue Ridge. Moreover, the limestones are fossiliferous and show clearly that their age is Cambro-Ordovician—the same as that of the limestones of the Shenandoah Valley. The rocks of the eastern side of the district are progressively more metamorphosed eastward and are practically devoid of fossils, although a few doubtful forms were found near Frederick Junction years ago. The natural interpretation is that these rocks are younger than the limestones of the Frederick Valley since the latter are dipping to the eastward beneath the mass of micaceous argyllites and sandstones. The frequent appearance of limestone valleys indicates that the structure is not simple and the finding of volcanic rocks similar to those of the Blue Ridge requires that judgment regarding the actual age of these eastern rocks be held in abeyance until the area has been mapped in detail.

At the present time it is possible to recognize the following types of rocks:

FORMATIONS OF THE WESTERN PIEDMONT PLATEAU.

SEDIMENTARY ROCKS.

	WESTERN SIDE.	EASTERN SIDE.
Mesozoic.		
Triassic	Newark Formation.	
Paleozoic.		
Cambro-Ordovician	Shenandoah Limestone	Schists and Argyllites Marbles and Limestones.
Cambrian	Weverton Sandstone.	Quartzites and Schists.

IGNEOUS ROCKS.

Mesozoic.		
Triassic	Diabase.	Diabase.
Archean	Basic volcanics. Acid volcanics.	Basic and Acid volcanics.

The succeeding discussion for completeness includes a few statements regarding the rocks of the Blue Ridge, the eastern base of which is generally considered the western limit of the Piedmont Plateau. A complete discussion of this region has already been given by Mr. Keith and a summary statement may be found in the succeeding pages.

Sedimentary Rocks.

The Quartzites and Schists.—Areas of quartzite, chiefly in ridges more or less timbered, have been occasionally found in the preliminary study of the western district of the Piedmont. They appear to be similar lithologically to the Weverton sandstones of the mountains on the west. The stratigraphic position of these silicious rocks with relation to the marbles and limestones has not been established. At times they appear to be above the latter and at other times below them. The more detailed work of the future will probably show their true positions and it is quite possible that there are several quartzose layers situated at different horizons.

The schists of the region include many of the more metamorphosed areas of what were formerly called phyllite, and future work will doubtless show considerable diversity of character in the rocks which are here united as a single unit. It is known that among them are both acid and basic volcanics, some of which have been distinguished upon the map. The main mass is composed of highly argillaceous micaceous rocks which, on disintegration and decomposition, form the "isinglass" soil of the region.

The Marbles.—The highly calcareous rocks here referred to embrace those lying east of the Frederick Valley. They are more crystalline than are those of the latter locality and are, so far as is known, devoid of fossils. Whether or not they are local areas of more highly metamorphosed limestones of Shenandoah age has not been definitely settled, but this conclusion appears to be the one naturally suggested by the areal distribution of the marble exposures.

These marbles, which are frequently beautifully colored, occur in long narrow valleys, especially in the region of the Western Maryland Railroad. Exposures are few, owing to their relative weakness, and most of the areas underlain by these rocks are excellent farming lands. In the marbles, especially when they are associated with volcanic rocks, are small deposits of lead and copper, but no one of these appears to be profitable under present market conditions.

THE SCHISTS AND ARGYLLITES.—Clearly overlying the marbles and separated from them by unconformities are certain schists and argyllites, part of the mass formerly called phyllites. The areal distribution of these overlying argillaceous rocks has not been determined and even the lithologic criteria for separating them from the older schists lying unconformably under the marbles have not been recognized. The work of discriminating these two lithologically similar formations and the determination of their areal distribution cannot be accomplished until topographic maps have been made for Carroll, Frederick, and Montgomery counties. Until that is done it is necessary to regard them as members of a complex whose relationships are yet to be deciphered.

WEVERTON SANDSTONE.—Isolated areas of quartzitic sandstone similar to the sandstone of the mountains are developed along the eastern side of the Monocacy Valley in Frederick County. The most extensive deposit of this formation occurs in Sugar Loaf Mountain, near the boundary of Montgomery County. Here the sandstone is very homogeneous, fine grained, and compact, and very light in color. This formation continues towards the north in a few insignificant patches, and similar quartzites of undetermined correlation occur at several points in the western Piedmont.

THE SHENANDOAH LIMESTONE.—Along the extreme western border of the plateau country in the Frederick Valley is an extensive development of Shenandoah limestone similar to the more extensive development of this formation in the Hagerstown Valley. This limestone has been largely worked for agricultural and structural lime and by its disintegration high-class farming lands have been produced.

THE NEWARK FORMATION.—The rocks of Triassic age are mainly confined to the western margin of the Piedmont Plateau and are represented by both sedimentary and eruptive materials. The deposits of the Newark formation unconformably overlie the limestone and phyllite which have been above described and cover a considerable area. Beginning as a belt some ten miles in width in northern Carroll and Frederick counties, the formation gradually narrows toward the south, until in the region of Frederick its full width does not exceed one mile, while at one point directly to the west of Frederick the continuity of the beds is completely broken. Farther southward in western Montgomery County the belt of Newark deposits again broadens to a width of several miles.

The rocks of this formation consist largely of red and gray sandstones and conglomerates of both silicious and calcareous varieties. The finer grained and deeper colored deposits generally have their individual elements united by a ferruginous cement, while the calcareous conglomerate, which is largely made up of rounded limestone pebbles, is generally imbedded in a reddish matrix. All of the deposits present structures which indicate that they were formed in shallow water, the coarse conglomerates, the ripple-marked surfaces, and the tracks of animals all pointing indisputably to this conclusion.

Igneous Rocks.

The Basic Volcanics in the Piedmont and in the mountains seem to be remarkably alike. They are essentially bluish-green with white masses of epidote and quartz which on exposure become dull gray or yellow. The honeycombed or amygdaloidal character of many of the masses increases the individuality of these rocks which usually form rough surfaced ledges or areas thickly strewn with characteristic boulders. The original character of these basic volcanics was that of a diabase or andesite, but the subsequent metamorphism which they have suffered has often rendered them schistose and obscured their original appearance. Several more or less parallel and extended areas of these epidotic rocks will doubtless be found in the western district of the Piedmont, where they are usually noticeable as low ridges or rocky outcrops.

The Acid Volcanics.—When only slightly metamorphosed, as in certain localities in the Blue Ridge, the acid volcanics are close-grained, dark bluish-gray or purplish rocks, frequently speckled with small feldspar phenocrysts. In the Piedmont occurrences, however, these highly silicious volcanics have usually been modified by pressure until, in extreme instances, they are fissile slates. In the quarry, they may appear solid and massive and flecked with feldspars, but even here the schistosity is generally evident. The more metamorphosed phases of these acid volcanics—meta-rhyolites—have often been overlooked among the phyllites, and subsequent detailed mapping in Frederick and Carroll counties will doubtless show them more abundant than has hitherto been thought. They usually carry more or less potash, which fact, with their easy disintegration, explains the excellence of the soils which they produce.

These same rocks occupy considerable areas in the mountains but here their higher altitude and inaccessibility render them less important. The unconformity between these phyllitic meta-rhyolites and the overlying rocks is seen by the frequent absence of one or more of the younger formations.

THE DIABASE.—The sandstones and shales of the Newark formation, as well as the rocks of earlier age, are found penetrated by dikes of the igneous rock diabase. These dikes extend across the area, for the most part, in a north-south direction, and throughout central Frederick and Carroll counties, where the covering of sandstones and shales has been removed, are found penetrating the limestones and phyllites. It seems probable that the dikes, referred to as occurring in the eastern division of the Piedmont Plateau, are of contemporaneous origin. The diabase is holocrystalline and is composed chiefly of plagioclase and pyrozene with olivene and magnetite. The rocks penetrated have been at times considerably metamorphosed by the molten rock, which was forced into their fissures, generally with a hardening of the beds by partial solidification and re-crystallization. The diabase decomposes with considerable rapidity, although the surface is generally covered with large boulders of undecayed material which show characteristic weathering.

THE APPALACHIAN REGION.

The geology of the Appalachian Region, as in the case of the Piedmont Plateau, cannot be fully comprehended without taking into consideration the great belt of which it forms a part. The beds of sediments which form the limestones, sandstones, and shales of the Appalachian mountains were deposited in a wide, long trough, which once extended from north to south throughout the region now occupied by the mountains. This trough was undergoing gradual depression through most of Paleozoic time, until many thousands of feet of conformable beds had accumulated in it, mainly as the debris of a continental mass lying to the east.

This vast accumulation, at the close of Paleozoic time, was so compressed as to be forced up into a series of great folds. The present Appalachians are merely the remains of these ancient folds worn down by natural processes through many successive periods. It is by no means certain that the mountain crests ever stood higher than at present, for from the moment the land rose above the sea the forces of denudation became active, and with varying intensity have continued to the present day. The great folds have been from time to time planed down, to be again sculptured as the result of elevatory movements. The compressive force which raised these mountains probably acted from the east toward the west, since the most intense disturbance is always observable in the eastern portion of the range and dies away gradually into the central plains. A secondary result attributed to this action from the east, is that all the folds are tipped toward the west and all the great faults show a thrust in the same direction. In consequence of this the older sediments are toward the east and the younger toward the west, although the more or less abrupt folds into which they were thrown, when raised into a mountain chain, have since been cut off by erosion in such a manner as to show a repeated succession of strata and at the same time to present in portions of the eastern border area rocks of still earlier age.

The section made by Maryland across the Appalachian system between the Frederick Valley and the western line of Garrett County presents an almost complete series of these various formations. As has been already pointed out, the mountain system of Maryland is divisible into three distinct physiographic and geologic districts, but as the features of each division appear to some extent repeated in that which is adjacent to it, it seems more desirable to treat the geology of the Appalachian Region as a unit, and describe under each formation its distribution, character, and structure. Reference to the map will show the relations which these formations bear to the several geographic divisions.

The following divisions are recognized in the rocks of the Appalachian Region:

FORMATIONS OF THE APPALACHIAN REGION.

SEDIMENTARY ROCKS.

Paleozoic.		
Permian (?)	Dunkard	= Coal Measures.
Carboniferous.		
Pennsylvanian	Monongahela	
	Conemaugh	
	Allegheny	
	Pottsville	
Mississippian	Mauch Chunk.	
	Greenbrier.	
	Pocono.	
Devonian.		
Upper Devonian	Hampshire.	
	Jennings.	
	Chemung.	
	Portage.	
	Genesee.	
Middle Devonian	Romney.	
	Hamilton.	
	Marcellus.	
Lower Devonian	Oriskany.	
	Helderberg.	
	Becraft.	
	New Scotland.	
	Coeymans.	
Silurian	Cayuga.	
	Manlius.	
	Salina.	
	Niagara.	
	Clinton.	
	Tuscarora.	
	Juniata.	
Ordovician	Martinsburg.	Chambersburg.
	Shenandoah (upper part)	Stones River.
Cambrian	Shenandoah (lower part)	Knox.
	Antietam.	Elbrook.
	Harpers.	Waynesboro.
	Weverton.	Johnstown.
	Loudon.	

Igneous Rocks.

Paleozoic Archean.......	Granites.
	Basic volcanics.
	Acid volcanics.

SEDIMENTARY ROCKS.

The Cambrian Period.

The rocks of the Cambrian are confined to the eastern division of the Appalachian Region, previously described as comprising the Blue Ridge and Great Valley, and cover considerable areas in Frederick and Washington counties. They consist of sedimentary materials that have been much metamorphosed since they were deposited, and also subjected to marked structural disturbances, rendering their relations at times difficult of interpretation. Five divisions have been recognized in the sequence of Cambrian deposits, known respectively as the Loudon, Weverton, Harpers, Antietam, and Shenandoah formations, the latter, however, being also in part of Ordovician age.

The Loudon Formation.—The Loudon formation, so called from its typical development in Loudon County, Virginia, is represented in Maryland in long narrow belts of rock accompanying the mountain ridges, and is found in the Catoctin Mountain, the Blue Ridge, and the Elk Ridge. The deposits consist largely of a fine dark slate with limestones, shales, sandstones, and conglomerates. The coarser and thicker deposits are found in narrow synclines upon the surface of the pre-Cambrian rocks; the thinner and finer beds are in the synclines, which are overlain by the Weverton sandstone. The limestones occur in the form of lenses in the slate and are best developed along the eastern side of the district just to the west of the Catoctin Mountain, where they are generally highly metamorphosed. Beds of sandstone occur in the Loudon formation, although more prominently developed to the south of the Potomac River. The thickness of the formation is very variable, ranging from a few to over 500 feet.

The formation as a whole has been much metamorphosed, alteration being most apparent in the argillaceous beds, which have been changed into slates and schists, all traces of the original bedding being frequently lost. The slate readily decomposes, forming low ground, but the more silicious rocks commonly occur as small hills or ridges.

THE WEVERTON FORMATION.—The Weverton formation, so called from its occurrence near Weverton, at the point where the Blue Ridge reaches the Potomac River, consists of massive beds of fine, pure sandstone, quartzite, and conglomerate. They are usually white, the coarser beds somewhat gray. In the Blue Ridge the sandstones are streaked with black and bluish bands. The deposits are mainly composed of quartz grains, which are well worn and are washed quite clean of fine argillaceous materials. They at times show cross-bedding, which indicates that the formation was largely laid down in shallow water. The thickness of the formation is quite variable, between 200 and 300 feet.

The Weverton sandstone has been subjected to but little metamorphism, as the quartz particles which comprise the deposits do not afford materials which admit of much alteration. Slight schistosity is evident in the southern part of the Catoctin Mountain. The sandstone decays slowly and generally forms projecting ledges on the surface of the country.

THE HARPERS FORMATION.—The Harpers formation, so called from its typical occurrence at Harper's Ferry, is composed largely of sandy shales with a few sandstone layers imbedded in its upper portion. The shales are of a dull bluish-gray color when fresh, and weather to a light greenish-gray. Argillaceous materials predominate, with frequent small grains of quartz and feldspar, while other materials derived from the pre-Cambrian volcanics appear sparingly. The thickness of the Harpers formation is difficult to determine, owing to the absence of any complete section of it. Its outcrops are everywhere included between faults which have cut off intermediate thicknesses. It has been estimated, as the result of a number of measurements, to have a probable thickness of 1200 feet.

The shales have been subjected everywhere to considerable alteration, the feldspathic materials being partially re-crystallized into quartz and mica, with the development of schistosity. The metamorphism is much more pronounced along the eastern border, in the Catoctin area, where the change has proceeded so far as to produce a mica-schist in which small quartz lenses are developed between the layers. Decomposition has affected the shale to considerable depths, the argillaceous materials furnishing a sufficient amount of clay to produce a soil of some value, but on steep slopes it is easily washed.

The Antietam Formation.—The Antietam formation receives its name from Antietam Creek, along the tributaries of which the deposits of this formation are most typically developed. The rock is a sandstone which grades below by gradual transitions into the Harpers shale. The sandstone is composed of small grains of white quartzite well worn and sorted, and it contains a small percentage of carbonate of line. Its color is almost invariably of a dull brown. It is more fossiliferous than the other Cambrian formations, remains of trilobites being not uncommon. The formation has a thickness of about 500 feet.

The Antietam sandstone shows little alteration in its typical area, but east of Catoctin Mountain there are some very silicious schists that may possibly represent it. The more calcareous varieties weather readily, but numerous blocks of the sandstone generally strew the surface.

The Shenandoah Formation (lower part).—The Shenandoah formation, so called from the fact that it forms the floor of the Shenandoah Valley, a part of the Great Valley above described, is composed of a series of blue and gray limestones and dolomites in which are locally slates and sandy shales imbedded. In certain places in eastern Washington County beds of pure fine-grained white marble are also found. The thickness of the entire Shenandoah formation is estimated to reach approximately 5000 feet. The upper part of this formation is of Ordovician age as shown by numerous fossils, while the lower part is to be referred to Cambrian time. The recent work of G. W. Stose of the U. S. Geological Survey in the near-by regions of Pennsylvania has shown the possibility of dividing the Shenandoah formation into independent stratigraphic units so that the term Shenandoah formation will probably in time be retained only as a group name. The following divisions have been referred to Cambrian time.

Tomstown Limestone.—Drab to white magnesian limestone. Thickness with preceding division 1500 feet.

Waynesboro Shale and Sandstone.—Purple to gray shale and flaggy sandstones. Lower Cambrian fossils at the top.

Elbrook Limestone.—Massive bluish gray magnesian limestone with some red and green shale and chert beds. 2000 feet thick.

Knox Limestone (lower part).—Drab magnesian and silicious limestones with limestone conglomerate at the base. Upper Cambrian fossils below. Entire division 1000 feet thick.

The limestone deposits have been but little altered, but the shaley beds have been generally more metamorphosed with the production of mica, which causes a more or less clearly defined schistosity. The decay of the limestone through solution has left an insoluble residuum of red clay, through which protrude at times beds of harder materials. The more rapid solution of the Shenandoah limestone than the rocks of the other formations has produced the broad fertile Hagerstown Valley. Similar deposits also underlie much of the Frederick Valley as well.

The Ordovician Period.

The rocks of the Ordovician period occur in both the Frederick Valley and the Great Valley in association with the Shenandoah formation (lower part) just described. They consist of sedimentary materials that have been on the whole less metamorphosed than the Cambrian rocks. They have been much folded and at places are faulted. This period comprises two divisions known respectively as the Shenandoah (upper part) and Martinsburg formations.

The Shenandoah Formation (upper part).—The Shenandoah formation, which has already been described in the previous pages as in part of Ordovician age, contains an abundant fauna of fossil brachiopods, gastropods, corals, and crinoids in its upper beds. The line of separation between the Cambrian and Ordovician portions of this formation cannot always be definitely determined.

The upper part of the Shenandoah limestone of Ordovician age has been divided as follows by Mr. Stose:

Knox Limestone (upper part).—Drab magnesian and silicious limestones containing Beekmantown fossils. Entire division 1000 feet thick.

Stones River Limestone.—Homogeneous, dove-colored, pure limestone, somewhat fossiliferous, 900 feet thick.

Chambersburg Limestone.—Crystalline fossiliferous limestone of Black River age 200 feet thick.

The Martinsburg Formation (Utica-Hudson River), so called from its typical development in the vicinity of Martinsburg, West Virginia, occurs in several areas along the western border of the Hagerstown Valley and in the region immediately adjacent to it upon the west. This formation consists of sandstone and of black and gray calcareous and argillaceous shales which are fine grained and show but slight variations within the limits of the State of Maryland. The shales bear from five to twenty per cent of carbonate of lime. The deposits were formed in shallow seas which abounded in graptolites, corals, brachiopods, and trilobites which have left abundant fossil remains. The fauna comprises that of the Utica and Hudson River shales of New York. The thickness of the formation varies from 700 to 1000 feet.

There has been but slight alteration in the shale, which is usually not sufficient to obscure the bedding which, however, was never sharply marked. The rocks of this formation have suffered considerable decay as the result of the solution of the carbonate of lime contained in them.

The Silurian Period.

The rocks of the Silurian period occur to the west of the deposits of Ordovician age just described, entering into the formation of the Appalachian Mountains in association with strata of Devonian age. They have been less metamorphosed and less faulted than the strata of the older formations. Five divisions have been recognized in the sequence of Silurian deposits, known respectively as the Juniata, Tuscarora, Clinton, Niagara, and Cayuga formations.

The Juniata Formation (red Medina), so called from its typical occurrence upon the Juniata River in Pennsylvania, is limited to the western portion of the central division of the Appalachian Region, in western Allegany County. It is best developed in "The Narrows" of Wills Mountain, to the northwest of Cumberland. The formation consists of alternating shales and sandstones of a deep red color. No fossils have been observed in it in Maryland. The formation has a thickness in Wills Mountain, of at least 550 feet.

THE TUSCARORA FORMATION (white Medina), so called from its typical development in Tuscarora Mountain in Pennsylvania, is found at widely separated points in the Appalachian district. Upon the east it enters into the formation of North Mountain, the most eastern ridge of the central Appalachians, and upon the west forms Wills Mountain just to the west of Cumberland, and also occurs at several points in the intervening country. The rock is chiefly sandstone, which is hard and massive, generally white or gray in color, and consists for the most part of coarse quartz grains. Few fossils have been found in the Tuscarora formation, but it is the undoubted equivalent of the white Medina sandstone of the north. The thickness of the formation is 287 feet on Wills Mountain. The deposits of the Tuscarora formation have been subjected to little alteration and the hard sandstone stands out as ridges upon the surface.

THE CLINTON FORMATION (Rockwood) is named from its typical exposure at Clinton, New York. It is confined to the central Appalachian Region, occurring in three, narrow, isolated belts west of Hancock, Washington County, and in three V-shaped areas in Allegany County about the Wills Mountain, Evitts Mountain, and Tussey's Mountain anticlines. It is composed of shales of a grayish-olive to reddish color interbedded with thin sandstones, which give place to thin-bedded limestones near the top of the formation. Two beds of iron ore (hematite) of a deep red color are contained in it, one 6 inches to 30 feet thick occurring near its base, and another about 1 foot thick near its summit. The latter usually overlies a heavy quartzitic sandstone. The original character of these two bands of iron ore was probably that of a highly ferruginous fossiliferous limestone from which the calcium carbonate has been removed by solution. The shale between the iron-ore beds usually suffers much erosion, producing characteristic valleys. Fossils are numerous in the iron ores and occur very abundantly in the upper shales and limestones. The thickness of the formation varies from 500 to 600 feet.

THE NIAGARA FORMATION (Lewistown, lower part), is named from its typical exposure at Niagara Falls, New York. It overlies the Clinton formation, surrounding the outcrops of the latter at the localities cited above. Its lower part consists of thin-bedded, blue limestones with partings of greenish-gray to black shale. The shales become thicker and preponderate over the limestones in the upper part of the formation, its summit being formed by a heavy bed of sandstone which is often very ferruginous and which weathers into characteristic ridges. This formation contains numerous fossils, which occur chiefly in the calcareous shales and limestones, being especially abundant in the latter. The Niagara formation has a thickness of about 250 feet.

THE CAYUGA FORMATION (Lewistown, middle part), is named from its typical exposure at Cayuga Lake, New York. It is confined to the central Appalachian Region, occurring in Washington County both east and west of Hancock, and in Allegany County upon the Wills Mountain, Evitts Mountain, and Tussey's Mountain anticlines. It consists of impure limestones and shales. Two divisions are recognized in it, termed respectively the Salina and Manlius members of the Cayuga formation.

The Salina member, so named from its typical exposure at Salina, New York, is the lower division of the Cayuga formation. It consists of impure limestone and shales, the latter having a prevailing greenish tone. It contains four cement beds, some of which have been extensively worked for the manufacture of cement, rendering the Salina formation of much commercial importance. In the region about Hancock the lower strata of this member have a deep red color, a feature not observed further west. Minute crustacea, termed Ostracods, abound in certain strata, other fossils being rare. An excellent exposure is to be seen at Pinto, Allegany County, where the Salina has a thickness of 1125 feet.

The Manlius member is named from its typical exposure at Manlius, New York. It overlies the Salina member with which it is associated at the localities named above. It consists of thin-bedded, impure limestones, which become shaly in their lower third. It passes into the Salina beneath and into the Helderberg formation above, without marked change, being separated from them by differences in its fossils. The latter are numerous, including many new and interesting species of Cystids. Excellent exposures occur at the Devil's Backbone in Allegany County and in the quarries at Keyser, West Virginia. This member has a thickness of about 110 feet.

The Devonian Period.

The deposits of Devonian age enter, together with the Silurian rocks, into the formation of the central division of the Appalachian Region, and together with the Carboniferous deposits, into the formation of the Alleghany Plateau. They consist of sedimentary materials that have been but little altered since they were deposited, although in places subjected to considerable structural disturbances. Three divisions are recognized in the strata of Devonian age known respectively as the Lower Devonian, Middle Devonian, and Upper Devonian.

Lower Devonian.

The deposits of Lower Devonian age comprise two divisions known respectively as the Helderberg formation and the Oriskany formation.

THE HELDERBERG FORMATION (Lewistown, upper part), is named from its typical exposure in the Helderberg Mountains, Albany County, New York. It occurs in the central Appalachian Region, being exposed west of North Mountain and west of Hancock in Washington County, and upon the Wills Mountain, Evitts Mountain, and Tussey's Mountain anticlines in Allegany County, in association with the formation last described. It consists of limestones usually purer and more massive than those of the Cayuga formation, together with some shales. Numerous fossils occur in it, many of which are characteristic of the Helderberg formation of New York. It comprises three divisions in Maryland, known respectively as the Coeymans, New Scotland, and Becraft members of the Helderberg formation. Of these members, the last is restricted to the region about Cherry Run, West Virginia. This formation is frequently referred to the Silurian period. Its thickness is about 260 feet.

The Coeymans member, so called from its typical exposure at Coeymans, New York, consists of heavy-bedded limestone bearing, at some localities, chert near its base. Among its fossils are very large Stromatopora, which weather into curly, nodular masses. Its thickness is about 110 feet.

The New Scotland member, so called from its typical exposure at New Scotland, New York, consists of massive gray limestones with bands of chert. In some localities the limestone passes above into a shale. The thickness of this member is about 65 feet.

The Becraft member, so called from its typical exposure at Becraft Mountain, New York, consists of dark-blue, arenaceous limestone containing lumps of black chert. Its thickness is about 85 feet.

The Oriskany Formation (Monterey) is named from its typical exposure at Oriskany Falls, New York. It is confined, like the Silurian formations, to the central division of the Appalachian Region in western Washington and Allegany counties. The deposits of the Oriskany formation are typically rather coarse-grained, somewhat friable sandstones, white or yellow in color. At times the materials become very coarse-grained, resulting in a clearly defined conglomerate, while at other times, especially in the western portion of the area, the materials are fine-grained, with here and there interstratified layers of coarser materials. These deposits afford excellent glass sand. The sandstone is very fossiliferous and carrics the typical Oriskany fauna of the north. The formation has a thickness of about 350 feet.

Middle Devonian.

One division is recognized in the Middle Devonian deposits, known as the Romney formation.

The Romney Formation, so called from its typical exposure at Romney, West Virginia, is confined to the central division of the Appalachian

Region, and occupies very much the same areas as those given above for the Oriskany sandstone. It comprises two divisions known respectively as the Marcellus and Hamilton members of the Romney formation. Its thickness is about 1600 feet in its central area, diminishing to 500 to 600 feet west of Wills Mountain.

The Marcellus member, so called from its typical exposure at Marcellus, New York, consists of thin, fissile, black shales, which weather into thin, flat, black plates. Several thin bands of limestone frequently occur some distance above its base. It contains numerous fossils characteristic of the Marcellus formation of New York. Its thickness is about one-third that of the entire Romney formation.

The Hamilton member, so called from its typical exposure at Hamilton, New York, consists of black shales containing, usually, two heavy beds of sandstone, one of which is near the middle and the other near the top of this division. The upper part of the shales weather into yellow to brown, hackly fragments which are highly characteristic of the Hamilton. The lower part weathers into thin dark plates often closely resembling those of the Marcellus shales. Eastward near Elbow Ridge, a conglomerate developes in this member, while west of Wills Mountain the entire Romney formation thins, the sandstones becoming greatly reduced in volume. Fossils abound in this division, especially in its upper half, including many species characteristic of the Hamilton of New York. Its thickness is about two-thirds that of the entire Romney formation.

Upper Devonian.

The strata of Upper Devonian age contain two divisions termed respectively, the Jennings and the Hampshire formations.

THE JENNINGS FORMATION, so called from its typical development at Jennings Gap, Virginia, is found both throughout the central and western divisions of the Appalachian Region. Within the Appalachian Mountains proper it is frequently repeated throughout western Washington and Allegany counties and occurs as the oldest formation represented in the Alleghany Plateau of Garrett County. It underlies the well-known "glades." It comprises three divisions known respectively as

Fig. 1.—View of Folded Silurian Rocks near Hancock, Washington Co.

Fig. 2.—View of Horizontal Carboniferous Sandstone, Swallow Falls, Garrett County.

VIEWS SHOWING GEOLOGICAL FORMATIONS OF THE APPALACHIAN REGION.

the Genesee, Portage, and Chemung members of the Jennings formation. Its thickness is about 3800 to 4000 feet.

The Genesee member, so named from its typical exposure on the Genesee River in New York, occurs at the base of the Jennings formation throughout its extent in Allegany County, but is lacking in Washington County. It consists of a deep-black, fissile shale weathering into flat, black plates, and often exhibits the pronounced jointing so characteristic of the Genesee of New York. It abounds in the small fossils of the Naples fauna of New York. Its thickness is about 90 feet.

The Portage member, so named from its typical exposure at Portage, New York, consists of olive-green to gray shales, alternating with thin, fine-grained micaceous sandstones, the latter occasionally becoming 2 feet thick. The shales weather into thin, flat plates which contrast with the hackly fragments of the Romney shales below, while it is also more resistant to weathering than the Romney shales. It contains few fossils at most localities. The forms found are closely related to those of the Naples and Ithaca faunas of the Portage of New York. Its thickness is about 2000 feet.

The Chemung member, so named from its typical exposure at the Chemung Narrows in New York, consists of olive-green to brownish-red shales and sandstones. A conglomerate occurs near its base in Washington County, while a second conglomerate is found 500 to 600 feet below its summit in numerous localities, forming well-marked ridges in many instances. Certain strata abound in fossils which are closely related to those of the Chemung formation of New York. Its thickness is about 1700 to 1800 feet.

THE HAMPSHIRE FORMATION (Catskill in part).—The Hampshire formation, so called from Hampshire County, West Virginia, occurs, like the Jennings formation, both in the central and in the western portion of the Appalachian Region. It is best developed in the western portion of Allegany and Garrett counties, where excellent sections occur along the Alleghany Front, and may also be seen to good advantage in Jenning's and Braddock's runs west of Cumberland. From these latter points the strata dip beneath the Carboniferous rocks of Georges Creek Valley, occurring again in a broad Y-shaped belt which extends northeast to southwest across Garrett County. The deposits of the Hampshire formation consist principally of thin-bedded sandstones, separated by fine-grained shales, although at times the sandstones become thick-bedded, and may merge gradually into the shales. Shales predominate in the upper portion of the Hampshire. The formation is for the most part of a reddish color although at times the strata may be brown or gray. It yields a characteristic red soil. No fossils have as yet been obtained from the Hampshire formation in Maryland, but it is undoubtedly the equivalent of the Catskill of the North. Its thickness is about 2000 feet.

The Carboniferous Period.

The rocks of the Carboniferous period are confined to the western division of the Appalachian Region, where they largely constitute the Alleghany Plateau, and are found in western Allegany and Garrett counties. Two divisions are recognized in it, known respectively as the Mississippian and the Pennsylvanian.

Mississippian.

Three divisions are represented in the deposits of Mississippian age known as the Pocono, Greenbrier, and Mauch Chunk formations.

The Pocono Formation.—The Pocono formation, so called from Pocono, Pennsylvania, is the basal member of the Carboniferous and directly overlies the Hampshire formation above described. It occurs in a series of narrow belts which extend from northeast to southwest through western Allegany and Garrett counties. The Pocono formation consists mainly of hard, thin-bedded, flaggy sandstone which is seldom coarse-grained, although in a few instances slightly conglomeritic. Thin layers of black shale and coaly streaks, in which plant remains are sometimes preserved, occur in some localities, although not a conspicuous feature of the formation. The sandstones have afforded good flagging materials. The thickness of the formation varies from 258 to 300 feet, but the deposits are seldom well exposed. The sandstone is, however, a factor in the topography, and usually forms a line of foothills along the flanks of the mountains.

THE GREENBRIER FORMATION.—The Greenbrier formation, so called from Greenbrier County, West Virginia, occurs in very much the same areas in western Allegany and Garrett counties as above described for the Pocono sandstone, and outcrops above the line of foothills just described. The deposits consist mainly of limestone strata in which are interbedded shales and some sandstones. The limestones are more sandy toward the base. The limestones near the upper portion of the formation are of compact structure and gray in color. They are also at times marly in their upper layers and these marly strata are frequently fossiliferous. The limestone is burned locally for building and agricultural purposes. The formation has a thickness of about 225 feet.

THE MAUCH CHUNK FORMATION (Canaan). The Mauch Chunk formation, so called from Mauch Chunk, Pennsylvania, flanks the ridges of western Allegany and Garrett counties and grades gradually downward into the Greenbrier deposits. The strata consist chiefly of red shales, interstratified with flaggy, red-brown, fine-grained sandstones. The sandstone is at times micaceous. Thin beds of dark carbonaceous shales occur at times near the top of the formation. The deposits have a thickness of about 800 feet.

Pennsylvanian.

Four divisions are recognized in the strata of Pennsylvanian age known as the Pottsville, Allegheny, Conemaugh, and Monongahela formations.

THE POTTSVILLE FORMATION (Blackwater), so called from Pottsville, Pennsylvania, is the lowest division of the Coal Measures and forms the mountain ridges which border the coal basins. The Pottsville formation consists of beds of sandstone and conglomerate interstratified with sandy shales in which thin beds of coal are locally developed. The sandstones and conglomerates are mainly composed of fine quartz grains and pebbles which are commonly cemented by means of silicious materials. These coarse deposits are also frequently cross-bedded and are very irregular both in their extent and sequence. The more prominent subdivisions recognized in Maryland occur from top to bottom as follows:

Homewood sandstone.
Mount Savage or upper Mercer coal.
Mount Savage fire-clay.
Lower Mercer coal.
Upper Connoquenessing sandstone.
Quakertown coal.
Lower Connoquenessing sandstone.
Sharon coal.
Sharon sandstone.

The Pottsville formation has a thickness of 330 to 380 feet.

THE ALLEGHENY FORMATION (Savage and Bayard, lower part), is approximately the same as the division formerly termed the Lower Productive Coal Measures. It is named from its typical exposure upon the Allegheny River, Pennsylvania. It is the lowest of the coal-bearing formations in western Allegany and Garrett counties and occupies the basal portion of the basins within the synclines which are outlined by the Pottsville conglomerate. It consists of a series of sandstones, shales, limestones, and coal seams, of which the more prominent from above downward are as follows:

Upper Freeport coal.
Upper Freeport limestone and Bolivar fire-clay.
Upper Freeport sandstone.
Lower Freeport coal.
Lower Freeport limestone.
Lower Freeport sandstone.
Upper Kittanning coal.
Middle Kittanning coal. } "Davis" or "Six-foot" coal.
Lower Kittanning coal.
"Split-six" coal.
Kittanning sandstone.
Ferruginous limestone.
Clarion sandstone.
Clarion coal.
Brookville coal.

Of these coal seams, the Middle and Lower Kittanning ("Davis" or "Six-foot" coal) are next in importance to the "Big Vein" of the Monongahela formation. The Allegheny formation has a thickness of 260 to 350 feet.

THE CONEMAUGH FORMATION (Bayard, upper part and Fairfax), is approximately the same as the division formerly known as the Lower Barren Coal Measures. It receives its name from its typical exposure along the Conemaugh River in western Pennsylvania. It overlies the Allegheny formation, with which it is associated at the localities cited in the discussion of that formation. It consists of a series of sandstones, shales, conglomerates, limestones, and coal seams, the more prominent of which from above downward are as follows:

Little Pittsburg coal.
Lower Pittsburg limestone.
Connellsville sandstone.
Franklin or Little Clarksburg coal.
Clarksburg limestone.
Morgantown sandstone.
Elklick coal.
Ames or Crinoidal limestone.
Crinoidal coal.
Saltsburg sandstone.
Bakerstown coal.
Lower red shales.
Upper Cambridge limestone.
Buffalo sandstone.
Lower Cambridge limestone.
Masontown coal.
Upper Mahoning sandstone.
Mahoning coal.
Mahoning limestone.
Lower Mahoning sandstone.

The Conemaugh formation has a thickness of 600 to 700 feet.

The Monongahela Formation (Elkgarden) is approximately the same as the division formerly called the Upper Productive Coal Measures. It is named from its typical exposure along the Monongahela River in Pennsylvania. In Maryland this formation is restricted to the Georges Creek-Potomac basin. It consists of a series of shales, sandstones, limestones, and coal seams, of which following subdivisions arranged from top to bottom are the more prominent:

Waynesburg coal.
Waynesburg limestone.
Uniontown sandstone.
Uniontown coal.
Sewickley sandstone.
Upper Sewickley or Tyson coal.
Lower Sewickley coal.
Sewickley limestone.
Redstone coal.
Redstone limestone.
Pittsburg coal, "Big Vein," "Fourteen foot Vein."

The Pittsburg coal, known in Pennsylvania as the "Pittsburg Vein," is the most important coal-bearing seam in Maryland, affording coal of high quality and great purity, that has been a source of great wealth to the State. The Monongahela formation has a thickness of 240 to 260 feet.

The Permian Period.

The rocks which are here questionably referred to the Permian are confined to the central portion of the Georges Creek Valley in western Allegany County, where they rest with apparent conformity upon the Carboniferous deposits below. The single formation recognized in these rocks is denominated the Dunkard formation.

The Dunkard Formation (Frostburg) is approximately the same as the division formerly known as the Upper Barren Coal Measures. It is named from its typical exposure on Dunkard Creek, Pennsylvania. Its strata apparently conformably overlie the Monongahela formation of

Carboniferous age. It occurs in patches along the center of the Georges Creek Valley where erosion has left fragments capping the top of the higher lands. It consists of limestones, sandstones, shales, and coal seams, the more prominent of which arranged from above downwards are as follows in Maryland:

Jollytown limestone.
Jollytown coal.
Upper Washington limestone.
Washington coal.
Waynesburg "A" coal.
Waynesburg sandstone.

The formation was referred to the Permian period by Fontaine and I. C. White who recognized among its fossil plants, species of Permian age. The thickness of the Dunkard formation is about 390 feet.

IGNEOUS ROCKS.

The igneous rocks of the Appalachian district are limited to the eastern division of the Blue Ridge and Catoctin mountains. No rocks of igneous origin have been found in the part of Maryland lying west of the Hagerstown Valley. The igneous rocks of the Blue Ridge-Catoctin area are similar to those already described and may be classified under the heads of Acid volcanics, Basic volcanics, and Granites.

The Acid Volcanics.

The acid volcanics of the Appalachian district of Maryland occupy an irregular area north and northeast of Myersville near the head of the Middletown Valley between the Blue Ridge and Catoctin mountains. They form the higher slopes of the headwaters of Catoctin Creek and extend well up to the state line. They are closely related to similar masses in Pennsylvania and Virginia and are represented in several smaller outlying masses, some of which have already been described. The rocks are closed-grained, usually completely crystalline mixtures of quartz and feldspar which often show characteristic flow, spherulitic and even lithophysal textures. They were evidently formed by the eruption of a silicious magma to or near the surface under conditions similar to those shown by the more recent volcanic rocks of the far west. During the long periods of time since their eruption they have been much changed in character. The original glass has been changed to a mosaic of quartz and feldspar by slow crystallization thereby changing the luster of the rocks from vitreous to stony. Their color, when fresh, is dark-blue or gray or occasionally red and when long exposed to the weather light gray or pinkish white. The rocks included here have been called " porphyry," quartz-porphyry, quartzite, aporhyolite, metarhyolite, etc., and have occasioned much discussion as to their origin and probable content of copper because of their similarity to the copper-bearing rocks of Lake Superior.

The Basic Volcanics.

The basic volcanics of the Maryland Appalachian district are more wide-spread than the acid volcanics, occupying between two and three times as much surface as the latter. Like them they are also represented in masses of similar rock to the north and south of Maryland, and in detached bodies to the east of Catoctin Mountain, as already described. They were formed by intrusions of basic material both before and after the formation of the acid volcanics. The products of these intrusions, which were originally quite similar, have been changed by the varying conditions to which they have been subjected since they were first formed. The present rocks have been classed by Keith, who has studied them most carefully, as " Andesite " and " Catoctin schists." The andesite is found in adjacent areas in Virginia but has not been recognized in Maryland where the sole representative of the basic volcanics is the Catoctin schist. This schist forms practically all of the region between the eastern flanks of the Blue Ridge and the western flanks of Catoctin Mountain, except the central area occupied by acid volcanics and the southwestern part of the Middletown Valley along the Potomac where the volcanic rocks seem almost crowded out by the numerous intrusions of granite. The

Catoctin schist in fresh exposures is light bluish-green in color and its presence is usually indicated by a surface strewn either with gray or yellow slabs of the weathered schists or by blocks of quartz and epidote. Keith has shown that the original rock was a diabase which has now lost most of its characteristic features through the metamorphism which has developed the marked schistosity. The volcanic character of the original rock is occasionally attested by the presence of amygdaloidal varieties which resulted from cooling near the surface.

The Granites.

Intimately intermingled with and cutting the acid and basic volcanics already described are intricately anastamosing bodies of granite which occur in long narrow belts varying in breadth from a yard to six miles, with an average width of perhaps 100 yards. By far the greatest development is in the valley lands north of the Potomac River in the Middletown Valley. The granites vary somewhat in the coarseness of their grain and show marked evidences of metamorphic modification, the rocks sometimes resembling silicious schists. They carry only a moderate amount of mica and are frequently garnet, or epidote-bearing, the garnet-bearing variety being well exposed along the Potomac River between Weverton and Harpers Ferry.

THE COASTAL PLAIN.

The area of low land which borders the Piedmont Plateau on the east and passes with constantly decreasing elevation seaward has already been described under the name of the Coastal Plain. It is part of that great belt of low country which extends from New Jersey to the Gulf and is made up of geological formations of younger date than those which have been hitherto described. These later formations stand in marked contrast to the strata in other portions of the State in that they have been but slightly changed since they were deposited. Laid down one above another upon the eastern flank of the Piedmont Plateau when the sea occupied the present area of the Coastal Plain, these later sediments form a series of thin sheets which are inclined slightly to the seaward so that successively later formations are encountered in passing from the inland border of the region toward the coast. Oscillation of the sea floor with considerable variation both in the angle and direction of the tilting, went on, however, during the period of Coastal Plain deposition. As a result the stratigraphic relations of these formations, which have generally been held to be of the simplest character, possess in reality much complexity along their western margins, and it is not uncommon to find that intermediate members of the series are lacking, as the result of transgression, so that the discrimination of the different horizons, in the absence of fossils, often requires the most careful investigation.

The Coastal Plain sediments, deposited after a long break in time between the red sandstones and shales (Newark formation) of Triassic age (hitherto described as overlying the crystalline rocks of the western division of the Piedmont Plateau) and the lowermost of the series now to be considered, complete the sequence of geological formations found represented in Maryland. From the time deposition opened in the coastal region during late Jurassic or early Cretaceous time to the present nearly constant sedimentation has apparently been going on, although frequent unconformity appears along the landward margins of the different formations.

The formations of the Coastal Plain consist of the following:

FORMATIONS OF THE COASTAL PLAIN.

Sedimentary Rocks.

Cenozoic.		
Quaternary.		
Recent.		
Pleistocene	Talbot	= Columbia Group.
	Wicomico	
	Sunderland	
Tertiary.		
Pliocene	Lafayette.	
Miocene	St. Mary's	= Chesapeake Group.
	Choptank	
	Calvert	
Eocene	Nanjemoy	= Pamunkey Group.
	Aquia	

Mesozoic.			
Cretaceous.			
Upper Cretaceous	Rancocas.		
	Monmouth.		
	Matawan.		
	Magothy.		
Lower Cretaceous	Raritan		= Potomac Group.
	Patapsco		= Potomac Group.
Jurassic (?)			= Potomac Group.
Upper Jurassic (?)	Arundel		= Potomac Group.
	Patuxent		= Potomac Group.

SEDIMENTARY ROCKS.

The Jurassic (?) Period.

The formations which are here doubtfully referred to the Jurassic period find their chief development in Maryland and Virginia where they directly overlie the crystalline rocks of the Piedmont Plateau.

The Upper Jurassic (?).

The deposits must unquestionably be referred to the Upper Jurassic if they ultimately prove to antedate the Cretaceous. The reference of the beds to this horizon is based on the Dinosaurian remains which do not in the present state of our knowledge afford final proof as to age, although some vertebrate paleontologists, among them one of our leading authorities, are quite certain that they should be regarded as earlier than the Cretaceous. The plant remains likewise are not distinctive enough to make it possible to say whether the beds are certainly late Jurassic or early Cretaceous. Until these questions are finally settled, however, the deposits will be tentatively placed in the Upper Jurassic.

The Potomac Group (Lower Division).

The formations here described include the lower part of what was long known as the Potomac formation, so called from the Potomac River, in the drainage basin of which the deposits of this age are well shown, but which is now recognized as representing several quite distinct stratigraphic units. These lower formations have only been found in the middle Atlantic coastal area while the upper formations extend both to the northward and southward and in the highest members reach across New Jersey in the one direction and into the South Atlantic and Gulf states in the other. The Potomac was deposited largely under estuarine conditions, although marine forms begin to appear before the close of the period in New Jersey, indicating the temporary breaking of the seaward barrier.

The Potomac group is divided into the Patuxent and Arundel formations of possible Upper Jurassic age and the Patapsco and Raritan formations of Lower Cretaceous age.

The Patuxent Formation.—The Patuxent formation, so called from its typical development in the upper valleys of the Little and Big Patuxent rivers, is the basal formation of the Coastal Plain series, and is found lying directly upon the crystalline rocks of the Piedmont Plateau. It appears near the landward margin of the Coastal Plain and has been traced as a narrow and broken belt from Cecil County across Harford, Baltimore, Anne Arundel, and Prince George's counties to the border of the District of Columbia.

The deposits consist mainly of sand, sometimes quite pure and gritty, but generally containing a considerable amount of kaolinized feldspar, producing a clearly defined arkose. Clay lumps are at times scattered in considerable numbers through the arenaceous beds. Frequently the sands pass over gradually into sandy clays, and these in turn into argillaceous materials, which are commonly of light color, but often become highly colored and are locally not unlike the variegated clays of the Patapsco formation. The more arenaceous deposits are cross-bedded, and the whole formation gives evidence of shallow-water origin. The dip of the beds is about 40 feet in the mile to the southeast. The Patuxent formation is estimated to attain a thickness of about 350 feet, but it may be considerably thicker at some points.

The fossils which are poorly represented as compared with those of the overlying formations, consist chiefly of plants, including ferns, cycads, and conifers. The numerous silicified trunks of cycads which have been found scattered over the formations of the Potomac group in Maryland were probably originally preserved in the Patuxent sands.

In Virginia in strata along the James River which Lester F. Ward correlates with the Patuxent formation of Maryland there occur a few primitive types of dicotyledonous leaves. The fauna is limited to a single Unio and the remains of a fish.

THE ARUNDEL FORMATION.—The Arundel formation, so called from Anne Arundel County, where the strata are well developed, consists of a series of large and small lenses of iron ore-bearing clays which occupy ancient depressions in the surface of the Patuxent formation and are unconformable to that formation. These lenses have been traced all the way from Cecil County to the border of the District of Columbia. The clays are highly carbonaceous, lignitized trunks of trees being often encountered in an upright position with their larger roots still intact. Scattered through the tough dark clays are vast quantities of nodules of iron carbonate, at times reaching many tons in weight, and known to the miners under the name of "white ore." In the upper portion of the formation the carbonate ores have changed to hydrous oxides of iron, which the miners recognize under the name of "brown ore." The largest lenses have been found to reach a thickness of nearly 125 feet.

The fossils thus far found consist of Dinosaurian remains, which some regard as indisputable proof of the Upper Jurassic age of the deposits, although others have questioned this reference. Among the plant fossils which are much more abundant than in the underlying Patuxent formation, a considerable number of dicotyledonous leaves have been found, associated with an assemblage of ferns, cycads, and conifers, the latter groups showing mixed affinities with basal Cretaceous (wealden) or Jurassic floras of other areas. Both the physical and paleontological characteristics of the deposits point to swamp conditions as affording the only satisfactory explanation of the origin of this formation. This could have been brought about by landward tilting of the continent accompanied by a clogging of the drainage lines.

The Cretaceous Period.

The formations referred to the Cretaceous comprise representatives of both the Lower and Upper Cretaceous, a clearly marked unconformity occurring both at the base of the series as well as between the two groups of formations. The Cretaceous is better developed in the district embracing Maryland and New Jersey than in any other portions of the Atlantic border area.

The Lower Cretaceous.

The Lower Cretaceous formations overlie the Upper Jurassic deposits unconformably and in portions of the area transgress them on to the crystalline rocks below. They contain highly characteristic floras with clearly marked Neocomian features. They constitute the upper part of the Potomac group.

The Potomac Group (Upper Division).

The leading features of the Potomac group have been already described in the paragraphs devoted to the Lower Division.

The Patapsco Formation.—The Patapsco formation, so called from its typical occurrence in the valley of the Patapsco River, forms the lowest division of the Cretaceous deposits here described. It extends entirely across the State from the Delaware border to the Potomac River, and throughout this distance is one of the most important members of the Cretaceous series.

The deposits of this division consist chiefly of highly colored and variegated clays which grade over into lighter colored sandy clays, while sandy bands of coarser materials are at times interstratified. The sands frequently contain much decomposed feldspar and rounded lumps of clay also occur. The sands are often cross-bedded, and all the deposits give evidence of shallow-water origin. The formation is estimated to reach a thickness of 200 feet. The deposits rest unconformably upon the Arundel below and dip from 35 to 40 feet in the mile to the southeast.

The fossils obtained from this formation consist entirely of plant impressions and a few indeterminate molluscan shells. The flora is very rich both in species and individuals and contains a considerable representation of dicotyledonous types. The general assemblage is distinctly Lower Cretaceous.

THE RARITAN FORMATION.—The Raritan formation, so called from its typical development in the valley of the Raritan River in New Jersey, extends across that state into Maryland. It is found in Cecil and Kent counties and extends thence southwestward along the eastern border of Harford and Baltimore counties into Anne Arundel County, where it broadens out and occupies a large extent of country along the Severn River. Beyond the Patuxent Valley the area of outcrop narrows, as the result of the transgression of the overlying Upper Cretaceous strata.

The deposits of the Raritan formation consist chiefly of thick-bedded and light colored sands, which at times become gravels. Frequently in the lower portion of the formation the sands grade over into the clays, which are generally light in color and highly silicious, although they are sometimes deeply colored. The thickness of the Raritan formation reaches about 400 feet. The deposits overlie unconformably the Patapsco sediments below and dip about 35 feet in the mile to the southeast.

The fossils are quite distinct from those which are found in the Patapsco formation and abound much more largely in the remains of dicotyledonous types of vegetable life. Most of the species are identical with those found in the Amboy clays of New Jersey which form the northern extension of the formation as developed in Maryland.

The Upper Cretaceous.

The formations referred to the Upper Cretaceous overlie the Lower Cretaceous deposits unconformably. The lowest formation is of estuarine origin in Maryland while the highest formations are distinctly marine. They apparently represent the Cenomanian and Senonian with possibly the lower portions of the Danian of Europe.

THE MAGOTHY FORMATION.—The Magothy formation, so called from the Magothy River in Anne Arundel County, overlies the deposits of the Potomac group unconformably. It extends as a narrow belt from New Jersey southward along the eastern margin of the earlier formations. To the northward near the Raritan Bay in New Jersey it contains marine fossils but farther southward the fossils where present are confined to plant remains, the deposits having apparently been laid down in estuarine waters. The formation is evidently transitional between the Potomac group below and the distinctly marine deposits which characterize the Upper Cretaceous. The Magothy formation crosses Cecil and Kent counties on the Eastern Shore and Anne Arundel and Prince George's counties on the Western Shore.

The materials consist of sands and clays which change rapidly both horizontally and vertically. The sands are commonly of light color, although lenses with bands of darker sands occur. The clays often appear finely laminated with sand layers between and are occasionally nearly black in color due to the presence of vegetable matter. The thickness of the Magothy formation in Maryland is very variable, ranging from 90 feet down to 20 feet or less. Its average thickness is probably about 50 feet. The formation has a dip of 30 to 35 feet in the mile to the southeast. The fossil leaves of the Magothy formation represent a later flora than that of the Raritan, and apparently one of Cenomanian age.

The Matawan Formation.—The Matawan formation receives its name from Matawan Creek, New Jersey, in the vicinity of which it is extensively developed. It lies along the eastern margin of the Magothy formation upon which it rests unconformably. The Matawan formation is the most widely extended of the Upper Cretaceous deposits and reaches from the shores of the Raritan Bay across New Jersey, Delaware, and Maryland to the Potomac River. Within the limits of Maryland it forms a narrow belt which crosses southern Cecil and northern Kent counties and then re-appears upon the Western Shore in Charles and eastern Anne Arundel counties and thence continues southwestward with constantly narrowing confines across Prince George's County until it is represented only by a bed of a few feet in thickness on the bank of the Potomac River. It does not outcrop so far as known in Virginia, the Eocene deposits having completely overlapped the marine Cretaceous beds.

The deposits of the Matawan formation consist mainly of dark colored micaceous sandy clays which at times are somewhat more sandy in the upper portions and more argillaceous in the lower portions, although in general the formation is very homogeneous throughout, from Kent County southward. The formation has an average thickness of about 50 feet on the Eastern Shore but gradually thins southward until it is not over 10 feet in thickness in southern Prince George's County. The deposits have a dip of from 20 to 30 feet in the mile to the southeast. The fossils of the Matawan are highly characteristic of its Upper Cretaceous age. Numerous marine mollusca, among them several characteristic species of ammonites, are found among its fauna. The formation does not show the division into members which are recognized in the New Jersey region to the northward where four well-marked beds appear that can be traced across that State to the Raritan Bay.

THE MONMOUTH FORMATION.—The Monmouth formation, so called from its typical development in Monmouth County, New Jersey, overlies the Matawan formation conformably and extends from New Jersey southward across Delaware into Maryland, but is very much less extensively developed in the State of Maryland than to the northward, although some of its chief characteristics still prevail. The Monmouth formation lies to the east of the Matawan deposits already described and forms a narrow belt crossing Cecil, Kent, Anne Arundel, and portions of Prince George's counties but gradually disappears before the valley of the Potomac is reached as a result of the trangression of the Eocene deposits.

The divisions of the Monmouth formation, so typically developed in central and northern New Jersey, are lacking in Maryland, although the beds are rather more glauconitic in the upper portions than in the lower. The deposits as a whole are deficient in glauconite as compared with those of the New Jersey region, the materials appearing as reddish and pinkish sands with glauconitic beds locally developed. The deposits have a thickness of somewhat less than 100 feet upon the Eastern Shore which gradually diminishes until the formation finally thins out altogether in Prince George's County. The beds dip at an angle of from 20 to 30 feet in the mile to the southeast. The fossils of the Monmouth formation show some marked differences from those of the Matawan formation, particularly in the advent of *Belemnitella*. The fauna on the whole is much more closely associated with the Matawan than with the overlying Rancocas. Like the Matawan the deposits belong to the Upper Cretaceous and are to be correlated with the Senonian of Europe.

The Rancocas Formation.—The Rancocas formation, so called from its typical occurrence in the valley of Rancocas Creek in southern New Jersey where it conformably overlies the Monmouth formation, is well developed throughout that state and in Delaware, but due to the transgression of the basal Eocene deposits is wholly lacking so far as known, on the Eastern Shore of Maryland. A few localities in eastern Anne Arundel County in the valley of the Severn River contain fossils characteristic of this formation farther north and may represent small remnants of the Rancocas in that area, although it is possible that the materials may have been reworked and may now constitute part of the basal beds of the Eocene.

Farther to the north in Delaware the Rancocas formation consists of greensand marls which are frequently highly calcareous. The deposits are in general quite arenaceous and on the whole less glauconitic than the Sewell marls in New Jersey to which horizon they evidently belong. The formation has a thickness of about 20 feet in central Delaware but gradually thins out toward the Maryland line where the Eocene deposits have transgressed the Rancocas and directly overlie the Monmouth formation.

The Tertiary Period.

The Tertiary deposits of Maryland form part of a complex series of formations that extend from New Jersey southward to the Gulf. At no point in the middle Atlantic region is the series more complete or better exposed than in the Chesapeake Bay district and the bluffs along the Maryland and Virginia streams have been classic ground for the study of American Tertiary strata. These Tertiary beds unconformably overlie the Cretaceous deposits which they gradually transgress landward. The Tertiary of Maryland is chiefly represented by the Eocene and Miocene, although deposits of presumably Pliocene age also occur.

The Eocene.

The deposits of Eocene age lie above and to the east of those previously described. They strike across the State from northeast to southwest and can be traced southward into the State of Virginia. In the Potomac Valley they dip at about $12\frac{1}{2}$ feet in the mile to the southeast. Eocene deposits of different character appear farther southward and can be traced thence through the Gulf region. The beds are marine and fossils are numerous. The deposits constitute a single group known as the Pamunkey group.

The Pamunkey Group.

The Pamunkey group, so called from the Pamunkey River in Virginia, has an extensive development both in Maryland and Virginia. The surface of the Pamunkey group is largely covered by deposits of later date. Numerous outcrops occur along the streams, particularly in the valley of the Potomac River, the interstream portions of the country being generally covered by later deposits. The Pamunkey group has been divided into the Aquia and Nanjemoy formations.

THE AQUIA FORMATION.—The Aquia formation, so called from Aquia Creek which enters the Potomac from the Virginia side about 50 miles below Washington, is found unconformably overlying the Cretaceous deposits from Cecil County, Maryland, southwestward and southward as far as southern Virginia. From Cecil County it crosses Kent and the northern portion of Queen Anne's County on the Eastern Shore and thence extends across Anne Arundel, Prince George's, and Charles counties on the Western Shore, being particularly well exposed in the valley of the Potomac.

The deposits which consist chiefly of greensands and greensand marls, at times highly calcareous and less frequently argillaceous, have a thickness of about 100 feet at the point where the beds disappear below tide. From the records of well borings it is known that the beds thicken somewhat to the eastward. The fossils of the Aquia formation are numerous and distinctive and consist of characteristic lower Eocene mollusca and corals. The Aquia formation has been divided into the *Piscataway* and *Paspotansa* members each about 50 feet in thickness. The former is divided into 7 zones and the latter into 2 in the Potomac River area.

The Nanjemoy Formation.—The Nanjemoy formation, so called from Nanjemoy Creek which enters the Potomac River from the Maryland side in Charles County, is found conformably overlying the Aquia formation. So far as known it is confined to the Western Shore, outcropping at various points across southern Anne Arundel, northern Calvert, southern Prince George's, and central Charles counties. The most extensive sections of the Nanjemoy formation in Maryland are in the vicinity of Upper Marlboro, along the Patuxent River, and along the Potomac River in southern Charles County from Popes Creek northward. The best part of this section is opposite Charles County along the Virginia bank of the Potomac to the east of Potomac Creek.

The deposits consist of greensands, often highly argillaceous and less frequently calcareous than the lower beds, and with here and there layers containing abundant crystals and crystallized masses of gypsum. The thickness of the deposits is about 125 feet where best exposed, although the beds thicken to some extent eastward. The fossils of the Nanjemoy formation as in the case of the Aquia formation are numerous and distinctive, and although many are common to the Aquia formation, some are confined to the Nanjemoy formation alone. They are mainly marine mollusca. The Nanjemoy formation has been divided into the *Potopaco* and *Woodstock* members, the former 60 to 65 feet in thickness and the latter 50 to 60 feet. The Potopaco member is divided into 6 and the Woodstock into 2 zones in the Potomac region. The lowest zone of the Potopaco member is a very argillaceous bed and has been referred to as the Marlboro clay.

The Miocene.

The Miocene deposits of Maryland form part of a broad belt of middle Tertiary formations that extend from New Jersey southward to the Gulf. The strata attain considerable thickness and constitute the most important element in the Coastal Plain series with the possible exception of the Cretaceous formations. The deposits are mainly if not wholly marine and fossils are numerous at most horizons. They constitute a single group known as the Chesapeake group.

The Chesapeake Group.

The Chesapeake group, so called from the characteristic development of the deposits in the Chesapeake Bay region, occupies a wide area of distribution throughout the eastern and southern counties of the State. It overlies the Eocene formations unconformably and in places along the western margin transgresses them to the Cretaceous deposits below. The surface of the Chesapeake group is for the most part covered by the deposits of later date. Fine outcrops, however, occur along the larger stream channels and in the bluffs bordering the Chesapeake Bay and its estuaries. The Chesapeake group has been divided into the Calvert, Choptank, and St. Mary's formations.

THE CALVERT FORMATION.—The Calvert formation, so named from Calvert County, where in the Calvert Cliffs the best sections of Miocene deposits on the Atlantic border are found, extends across the State from northeast to southwest in a belt from 20 to 30 miles in width. Beginning in southern Kent County near the Delaware line, it crosses Queen Anne's and thence extends into the northern portions of Caroline and Talbot counties. On the Western Shore it forms a considerable portion of northern Calvert and St. Mary's counties, much of Charles County, and the southern portions of Anne Arundel and Prince George's counties.

The beds, which consist largely of sands, clays, marls, and diatomaceous earth, have a total thickness of about 200 feet, although it becomes less than this westward, while at the same time it thickens along the dip to the eastward. The dip is about 11 feet in the mile. The fossils are numerous, particularly in the upper member of the formation. The Calvert formation is divided into two clearly defined members, the *Fairhaven diatomaceous earth* below and the *Plum Point marls* above. The Fairhaven diatomaceous earth is very largely made up of the tests of diatoms imbedded in a very finely divided quartz matrix. The Plum Point marls consist of series of sands, clays, and marls, some of the beds being packed with molluscan shell remains.

THE CHOPTANK FORMATION.—The Choptank formation, which receives its name from the Choptank River on the northern bank of which the deposits of this age are well exposed, extends in a belt across the

FIG. 1.—VIEW OF MIOCENE BEDS, COVE POINT, CALVERT COUNTY.

FIG. 2.—VIEW OF PLEISTOCENE BEDS SHOWING FOSSIL SHELLS, CORNFIELD HARBOR, ST. MARY'S COUNTY.

VIEWS SHOWING GEOLOGICAL FORMATIONS OF THE COASTAL PLAIN.

State to the east of the Calvert formation and is found in Caroline, Talbot, and Dorchester counties on the Eastern Shore, in Anne Arundel, Calvert, Prince George's, Charles, and St. Mary's counties on the Western Shore. Like the preceding formation the deposits are deeply buried and few exposures are observable on the Eastern Shore. The Choptank formation overlies the Calvert formation unconformably and completely transgresses the latter to the northward in New Jersey where it rests directly on the Upper Cretaceous.

The deposits consist of sands, clays, and marls, with here and there indurated ledges. The fossils are very abundant and at times make up largely the beds in which they are found. The formation has a thickness of 125 feet, which like the Calvert formation thins to the westward and thickens down the dip to the eastward. The dip is about 10 feet in the mile toward the southeast. The numerous marine fossils, which are largely molluscan shells, afford a satisfactory basis of separation of the beds from the underlying and overlying formations.

THE ST. MARY'S FORMATION.—The St. Mary's formation, so called from St. Mary's County where the formation is well developed, especially along the St. Mary's River in the vicinity of St. Mary's City, crosses Maryland from northeast to southwest to the southeast of the Choptank formation. On the Eastern Shore it is buried beneath a mantle of later deposits. While it evidently occurs in Caroline, Talbot, Wicomico, and Dorchester counties no outcrops are known. On the Western Shore it has been found only in Calvert and St. Mary's counties. The deposits consist of clay, sand, and sandy-clay, the latter typically greenish-blue in color and bearing large quantities of fossils. Locally the beds have been indurated, and at times clusters of radiating gypsum crystals are found. The formation has a thickness of 150 feet, although it thins down to the northwestward and thickens seaward below tide, as shown by well borings. Its average dip is 10 feet to the mile. The fossils which consist largely of marine forms, among which mollusca predominate, are very numerous and afford a satisfactory basis for separating this formation from the other Miocene formations below it.

Pliocene.

The only formation which has been referred to this period within the State of Maryland is the Lafayette. Its age has been long in doubt and there are not yet sufficient data to refer it definitely to any period. All that can be said is that it is younger than the Miocene which it covers and older than the oldest Pleistocene beds found in the same vicinity. Within this region no fossils have been found, and elsewhere the fossil plants and animals alleged to have been obtained within its limits are not of a character sufficiently definite to determine its age. The correlation, therefore, can only be regarded as provisional and more definite evidence is needed before the question can be regarded as settled.

The Lafayette Formation.—The Lafayette formation, first named by Hilgard in Mississippi for deposits found well developed in Lafayette County in that State, has been traced around the continent border northward and is supposed to be represented in the deposits hitherto called by that name in Virginia, Maryland, and Pennsylvania where the last remnants of the formation are recognized. Within Maryland it crosses the State from northeast to southwest and is confined to the eastern margin of the Piedmont Plateau and the western border of the Coastal Plain. Throughout this area it is believed to have once extended as a continuous mantle westward over a considerable surface of the Piedmont Plateau and eastward over the Coastal Plain. At the present time it has suffered so much from erosion that in Maryland it has been reduced to a mere fragment of its former extent. The largest area is located on the Coastal Plain southeast of Washington where it forms the divide between the Patuxent and Potomac rivers as far south as Charlotte Hall. This area has been much dissected by stream erosion and around its borders there are many outliers which were separated from the larger mass by the removal of the material which once connected them. To the east of the Patuxent River at Marriott Hill and on the highest hills of Elk Neck at the head of the Bay are other scattered patches of Lafayette gravels which also rest on Coastal Plain deposits. Along the eastern slope of the Piedmont Plateau there is a long line of outliers which rest either on beds of Potomac or directly on the crystalline rocks of the

Piedmont. The most important of these are located in the western part of the District of Columbia, near Burtonville, at Catonsville, near Lochraven, near Stockton, and on the Piedmont area of Cecil County near Woodlawn.

The materials composing the Lafayette formation consist of clay, loam, sand, and gravel which are often highly ferruginous, the iron being present in the deposits as a cement binding the loose materials together in ledges of local development. The Lafayette materials were imperfectly sorted in the waters of the Lafayette sea and are now found intermingled in varying proportions. Although there is a rough bipartite division in the deposits as a whole whereby the gravel occurs in greater abundance at the base and the sand and loam at the top of the formation yet these elements are mixed together in a confusing manner. Irregular beds or lenses of loam, sand, and gravel are locally developed throughout the formation. Taken as a whole the gravel is considerably decayed and fine-grained, but in the vicinity of the Piedmont Plateau it becomes very coarse and is imbedded in a compact sand and stiff reddish clay loam. Usually the upper portion of the Lafayette is composed of a deposit of loam varying in thickness from a few inches to 10 feet or more. At times it is highly argillaceous; at other times decidedly arenaceous, but as a general rule it is of very fine texture. Along the Piedmont border this loam contains considerable iron and has a marked orange color. In southern Maryland it changes to a buff or yellow.

The Lafayette formation is chiefly developed as a terrace lying irregularly and unconformably on whatever older formation chances to be beneath it. These range from pre-Cambrian and Paleozoic (the metamorphic rocks of the Piedmont Plateau) up into the later beds of the Miocene series. Although the oldest of surficial deposits, the Lafayette formation lies topographically highest and at the center of a concentric border of younger terrace formations which wrap about it. The Lafayette formation has a thickness on the average of less than 50 feet, although at some points a thickness considerably greater has been observed.

The Quaternary Period.

The Quaternary deposits of Maryland and adjacent states form an extensive veneer throughout all but the highest portions of the Coastal Plain frequently burying from view the deposits of earlier age in the interstream areas. The Quaternary is represented by both the Pleistocene and the Recent.

The Pleistocene.

Superficially overlying most of the older formations throughout the greater part of the Coastal Plain and extending in places on to the Piedmont Plateau are beds of Pleistocene age which, with marked variations in thickness, composition and structure, extend from the glacial deposits of northern New Jersey through the south Atlantic and Gulf states to the Mexican border. The Pleistocene deposits in Maryland belong to a single division known as the Columbia group.

The Columbia Group.

The Columbia group, so called from the characteristic development of the deposits in the District of Columbia, is widely extended as surficial deposits throughout the eastern and southern counties of the State as well as along the main stream channels that extend into the region of the Piedmont Plateau. These deposits form a series of terraces that wrap about the Lafayette and the higher portions of the older formations and thence extend as fluviatile deposits up the stream courses. The Columbia group has been divided into the Sunderland, Wicomico, and Talbot formations.

The Sunderland Formation.—The Sunderland formation, so called from the hamlet of Sunderland in Calvert County, was formerly developed as a nearly continuous deposit of the Coastal Plain region of Maryland below the Lafayette highlands, but erosion has now removed it over wide areas. Like the Lafayette it finds its greatest development in Southern Maryland where it forms the divide of Calvert County and of Charles and St. Mary's counties west and south of the Lafayette area. Numerous outliers occur to the westward as in the case of the Lafayette formation.

A few of them are found within the body of the Coastal Plain region while many others occur either on the Piedmont Plateau or on the margin between it and the Coastal Plain. At the head of the Bay on Elk Neck it is developed as a fringe about and a little lower than the Lafayette.

The materials which compose the Sunderland formation consist of clay, loam, sand, gravel, peat, and ice-borne blocks. These as a rule do not occur in well defined beds but grade into each other both vertically and horizontally. The coarser materials, with the exception of the ice-borne boulders, are usually found with a cross-bedded structure while the clays and finer materials are either developed in lenses or are scattered throughout the formation and may occur in the gravel beneath or in the loam above. There is distinguishable throughout the formation a tendency for the coarser materials to occupy the lower portion and the finer the upper portion of the formation, but the transition from one to the other is not marked by an abrupt change and coarser materials are frequently found above in the loam and finer materials below in the gravel. As a whole, the material is coarser in the Potomac and Susquehanna basins than elsewhere.

The sources from which the Sunderland sea derived the materials for its deposits were principally confined to the Coastal Plain, although the rivers also brought in contributions from the Piedmont Plateau and the mountains of western Maryland. The thickness of the Sunderland formation is very variable. The average thickness probably does not exceed 25 feet, although at some points it reaches a thickness of from 60 to 80 feet. A few plant fossils have been recognized in the clay beds but the fossiliferous localities in the Sunderland formation are much fewer than in the later deposits of Pleistocene age.

THE WICOMICO FORMATION.—The Wicomico formation, so named for the Wicomico River in southern Maryland, has been developed as a broad terrace below and fringing the Sunderland, at times completely filling and largely obliterating the bottoms of the ancient stream valleys that trenched the Sunderland surface. It has at the present time a much larger areal development than the Sunderland and has been much less dissected by erosion than the latter, with the result that the terraced surface has been far better preserved. Its largest development is on the Eastern Shore where it forms the watershed throughout the center of the region, extending as far southward as Worcester County.

The materials which constitute the Wicomico formation are similar to those found in the Sunderland and in fact many of them have been derived from that formation. They consist of clay, loam, sand, gravel, peat, and ice-borne boulders. The distribution of these materials is similar to that described in the Sunderland in that they grade one into the other both vertically and horizontally, but with the preponderance of the coarser materials at the base of the formation while the finer deposits are largely developed toward the top.

The Wicomico sea derived its materials in much the same way as that of the Sunderland. The waves eroded the borders of the Lafayette and Sunderland formations, frequently reaching the deposits beneath and these reworked materials, together with sediments brought from the Piedmont Plateau and Appalachian Mountains, comprise the deposits laid down. The average thickness of the formation is somewhere from 25 to 30 feet, although it attains a thickness of about 70 feet at Turkey Point in Cecil County. Carbonaceous deposits of considerable thickness have been found in southern Maryland in which recognizable plant remains have been discovered.

The Talbot Formation.—The Talbot formation, the name for which is suggested by Talbot County where the formation is widely developed, occupies in Maryland the area between the margin of the older surficial deposits and the seashore. It wraps about the Wicomico and other terrace deposits as a border and extends up re-entrant valleys as a veneer. Erosion has attacked this terrace to such a slight extent that it may be considered as continuous, although here and there small areas have been separated from the otherwise unbroken surface. Like the Wicomico formation it finds its greatest development on the Eastern Shore and particularly in the southern portions of that area where it forms broad flats which decline lower and lower until they pass into marshes and blend imperceptibly with the beach. On the Western Shore it also has an extensive development, particularly toward the head of the Bay.

The materials which compose the Talbot formation consist of clays, loam, sands, gravel, peat, and ice-borne boulders. As in the Sunderland and Wicomico formations these materials grade into each other, although a bipartite division of the coarser materials beneath and the finer materials above is present in the Talbot as in the others. There is on the whole much less of decayed materials than in the preceding formations which gives to the Talbot a younger appearance. Cross-bedding is very common. In the western portions of the area throughout the Potomac and Susquehanna valleys the Talbot deposits frequently show large numbers of ice-borne boulders. These are also common in the upper portions of the Eastern Shore. The Talbot formation has an average thickness of about 30 feet which at times increases to 80 or 90 feet or thins down until it finally disappears. Many clay lenses containing remains of marine and estuarine animals and land plants occur near the main channels. Among the most important of these may be mentioned the clay beds of Bodkin Point containing huge cypress knees and stumps, and the marine deposits near Cornfield Harbor at the mouth of the Potomac River which contain a large assemblage of marine molluscan shells. These clay lenses are supposed to be deposits formed by lagoons which subsequently became filled. The fossils contained in these beds are in the main identical with those found at the same horizon in other states to the north and south of Maryland.

Recent.

The Recent deposits embrace chiefly those being laid down today over the submarine portion of the Coastal Plain and along the various estuaries and streams. To these must also be added such terrestrial deposits as talus, wind-blown sand, and humus. In short, all deposits which are being formed under water or on the land by natural agencies belong to this division of geological time.

The Recent terrace now under construction along the present ocean shore-line and in the bays and estuaries is the most significant of these deposits and is the last of the series of terrace formations which began with the Lafayette, the remnants of which today occupy the highest levels of the Coastal Plain and which has been followed in turn by the Sunderland, Wicomico, and Talbot.

Beaches, bars, spits, and other formations are built up on this terrace belt and are constantly changing their form and position with the variations in currents and winds. Along the streams flood plains are formed that in the varying heights of the water suffer changes more or less marked. On the land the higher slopes are often covered with debris produced by the action of frost and the heavy downpours of rain which form at times accumulations of large proportions known as talus and alluvial fans. An illustration of the former is seen in the Devil's Race-course on the western slope of the Blue Ridge, the heavy blocks in this instance being separated by the action of frost and subsequently precipitated down the steep mountain side.

A deposit of almost universal distribution in this climate is the humus or vegetable mold which being mixed with the loosened surface of the underlying rocks forms our agricultural soils. The intimate relationship therefore of the soils and underlying geological formations is evident.

The deposit of wind-blown sands more or less important everywhere, as may be readily demonstrated at every period of high winds, is especially marked along the sea-coast in Worcester County where sand dunes of considerable dimensions have been formed. Other accumulations in water and on land are going on about us all the time and with those already described represent the formations of Recent time.

MINERAL RESOURCES.

The mineral resources of Maryland have yielded a great variety of products, some of which afford the basis for important commercial enterprises, while others give promise of prospective value. Many of the Maryland minerals have been worked since early colonial days, especially the brick clays and the deposits of iron carbonate. The Maryland coal deposits also were early discovered, and have been the basis of an important industry for more than half a century. Still other mineral products have been developed within quite recent years, the annual value of the Maryland mineral output being steadily on the increase. The ancient crystalline rocks, confined for the most part to the Piedmont region between the Catoctin Mountain and the Chesapeake have afforded the most varied mineral substances. Here occur the most important building-stones; the slates of Delta and Ijamsville; the granite of Port Deposit, Woodstock, Ellicott City, and Guilford; the gneiss of Baltimore; the marble of Cockeysville and Texas; the crystalline limestone of Westminster; and the serpentine of Cardiff, Broad Creek, and Bare Hills. In these oldest rocks occur also the ores of gold, copper, chrome, lead, and zinc. Iron ore is also found here while all the flint, feldspar, kaolin, and mica in the State must be sought for in these rocks. These older rocks also appear in the Blue Ridge district where they form the Middletown Valley and have yielded traces of copper, antimony, and iron.

Rocks of later age, forming what geologists call the Paleozoic system, constitute the western section of the State. They furnish much sandstone and limestone suitable for building purposes, the latter also being burned extensively for agricultural uses. There are also important deposits of cement rock that have afforded the basis for an extensive industry. At the top of this Paleozoic system of rock formations are situated the coal beds of the famous Cumberland-Georges Creek coal basin, including the "Big Vein" that is universally thought to furnish the highest quality of steam and smithing coal. These same rocks also contain important deposits of fire-clay and iron ore, the former affording the basis for a very important fire-brick industry.

The post-Paleozoic formations of the State, although not as rich in mineral products, are not devoid of deposits of economic value. The interesting variegated limestone breccia, known as Potomac marble, and the brown sandstone of Frederick and Montgomery counties belong to the oldest of these post-Paleozoic strata. The series of still unconsolidated beds representing much of the remainder of post-Paleozoic time and comprising all of Eastern and Southern Maryland, and known as the Coastal Plain, furnishes the chief supply of brick, potter's and tile clay; of sand, marl, and diatomaceous earth (silica); and much of the iron ore. The clay industry, particularly, is one of the most important in the State and is largely based on the clays of this region.

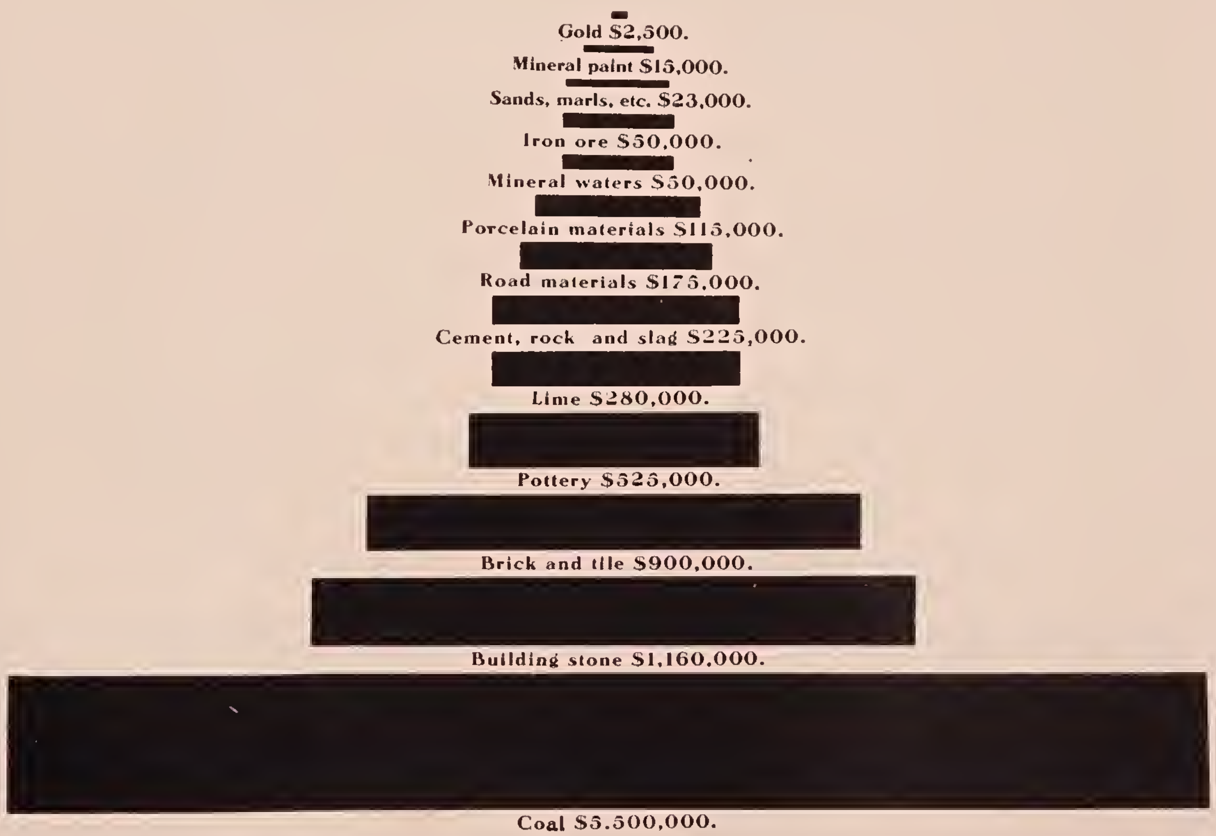

FIG. 5.—Diagram showing relative production of Maryland Mineral Industries.

The various economic products will be briefly considered in the following pages.

TABLE OF AVERAGE PRODUCTION OF MARYLAND MINERAL PRODUCTS.

Coal		$5,500,000
Clays and clay products:		
Brick and tile	$900,000	
Pottery	525,000	
Raw clays	10,000	
		1,435,000
Porcelain materials:		
Kaolin	$10,000	
Flint	85,000	
Feldspar	10,000	
		105,000
Sands		15,000
Marls		3,000
Silica or tripoli		5,000
Building stone:		
Granite and gneiss	$800,000	
Limestone	100,000	
Slate	125,000	
Marble and serpentine	100,000	
Sandstone	25,000	
Gabbro	5,000	
Miscellaneous	5,000	
		1,160,000
Cement, rock and slag		225,000
Lime (agricultural and building)		280,000
Iron ore (carbonate and hematite)		50,000
Mineral paints		15,000
Gold		2,500
Road materials		175,000
Mineral waters		50,000
Total		$9,020,500

THE COALS.

The coal deposits of Maryland are confined to western Allegany and Garrett counties and constitute a part of the great Appalachian coal field which covers portions of Pennsylvania, Maryland, Virginia, West Virginia, Ohio, Kentucky, Tennessee, and Alabama. Throughout the western portion of this field the rocks with their contained coal beds lie nearly horizontal, but to the eastward low folds that gradually increase in intensity are developed until the "canoe-shaped" basins of central Pennsylvania, western Maryland, and eastern West Virginia are reached. As a result of this increased folding eastward the coals have been metamorphosed through heat and pressure with a relative reduction in the amount of volatile carbon, the coals gradually changing from the soft bituminous to the semi-bituminous varieties with a further change to the hard anthracite still farther eastward in the anthracite field of Pennsylvania. In general the coal beds are thickest along

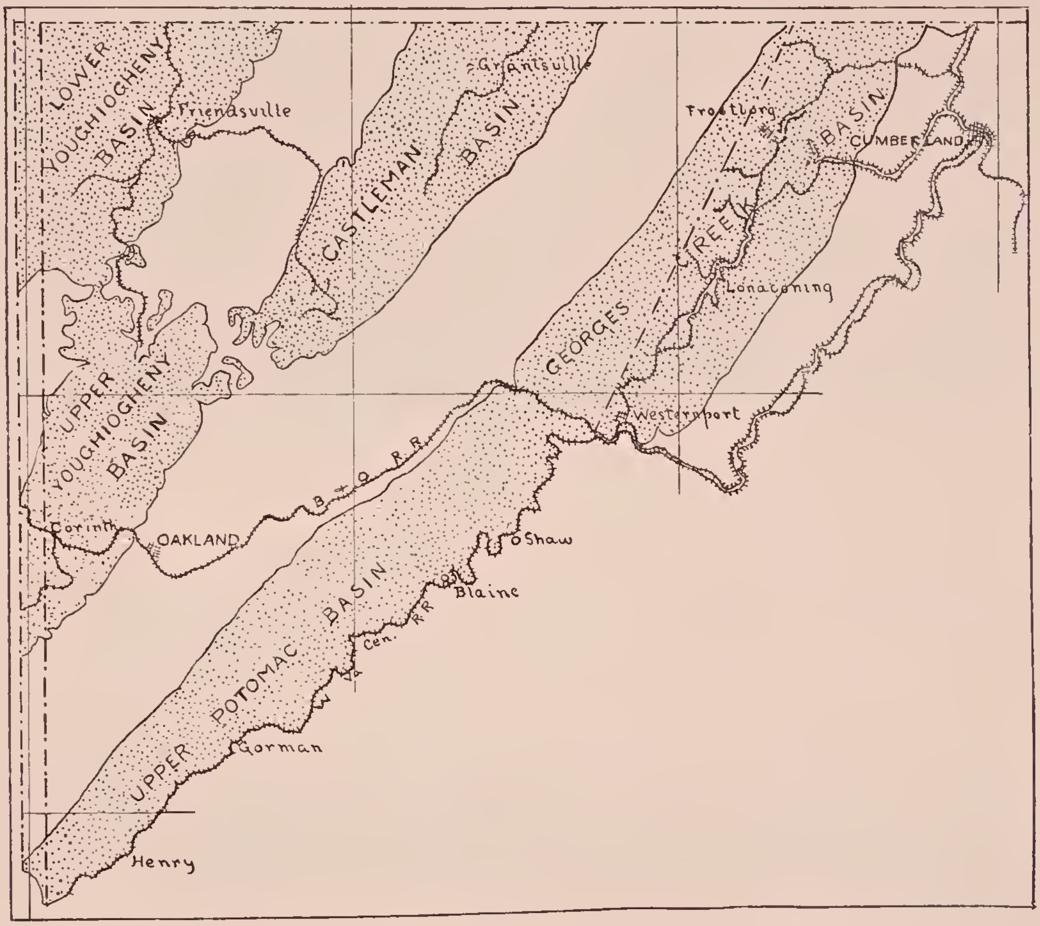

Fig. 6.—Map showing location of Maryland Coal Basins.

the eastern margin of the field and thin westward. Many of the coal seams can be traced continuously over thousands of square miles, while others have only a local development.

The Maryland coals belong to the group of semi-bituminous coals and possess great value for steam and smithing purposes. They are used extensively as fuel for locomotives, steamboats and factories, finding a ready market in Baltimore, New York, and elsewhere along the Atlantic border.

The Maryland coals occur in five basins, known as the Georges Creek basin, the Upper Potomac basin, the Castleman basin, the Lower Youghiogheny basin, and the Upper Youghiogheny basin. The present production of coal for the market is almost exclusively confined to the first two basins. The far greater prominence of the Georges Creek basin has led to the application of the name "Georges Creek coal" to most of the coal shipped from the State. Until within recent years practically all of this coal came from the Pittsburg seam or "Big Vein," but the gradual exhaustion of this wonderful seam has led to the exploitation with most satisfactory results of many of the "Small Veins" both above and below the chief seam. There are many companies to-day mining the smaller seams either exclusively or in conjunction with the large seam. There is unquestionably a great future for these smaller seams in Maryland, especially in the Upper Potomac basin in southern Garrett County, where they reach their greatest thickness. The total amount of coal in these small seams exceeds many fold that originally contained in the "Big Vein."

The many coal seams in the Maryland Coal Measures are shown on the accompanying vertical section. The figures given represent the thickness of the seams from roof to floor including the coal, bone, slate, etc.

The most important of the seams after the Pittsburg or "Big Vein" are the Upper Sewickley, the Bakerstown, the Upper Freeport, and the Middle and Lower Kittanning, all of which are being successfully mined at the present time.

THE FOLLOWING ANALYSES SHOW THE AVERAGE VALUES OF THE LEADING MARYLAND COALS.

Coal Seams.	Moisture.	Volatile Carbon.	Fixed Carbon.	Ash.	Sulphur.	Calorimetric Values in Calories.	Calorimetric Values in B.T.U.
Upper Sewickley or "Tyson"......	.83	20.22	70.09	8.86	1.40	7784	14,011
Pittsburg or "Big Vein"............	.70	18.78	73.13	7.12	1.02	7920	14,256
Bakerstown or "Four-foot".....	1.10	18.64	70.32	9.94	2.07	7757	13,973
Upper Feeeport or "Three-foot".	1.21	19.47	68.70	10.17	1.73	7764	13,975
Lower Kittanning or "Six-foot"....	1.26	19.52	67.20	12.01	2.13	7484	13,471
Brookville...........	.91	21.04	68.83	9.22	1.30	7729	13,912

FIG. 1.—OUTCROP OF PITTSBURG SEAM, NEAR LONACONING, ALLEGANY COUNTY.

FIG. 2.—CONSOLIDATION COAL COMPANY, OCEAN NO. 7, ALLEGANY COUNTY.

VIEWS OF MARYLAND COAL MINING INDUSTRY.

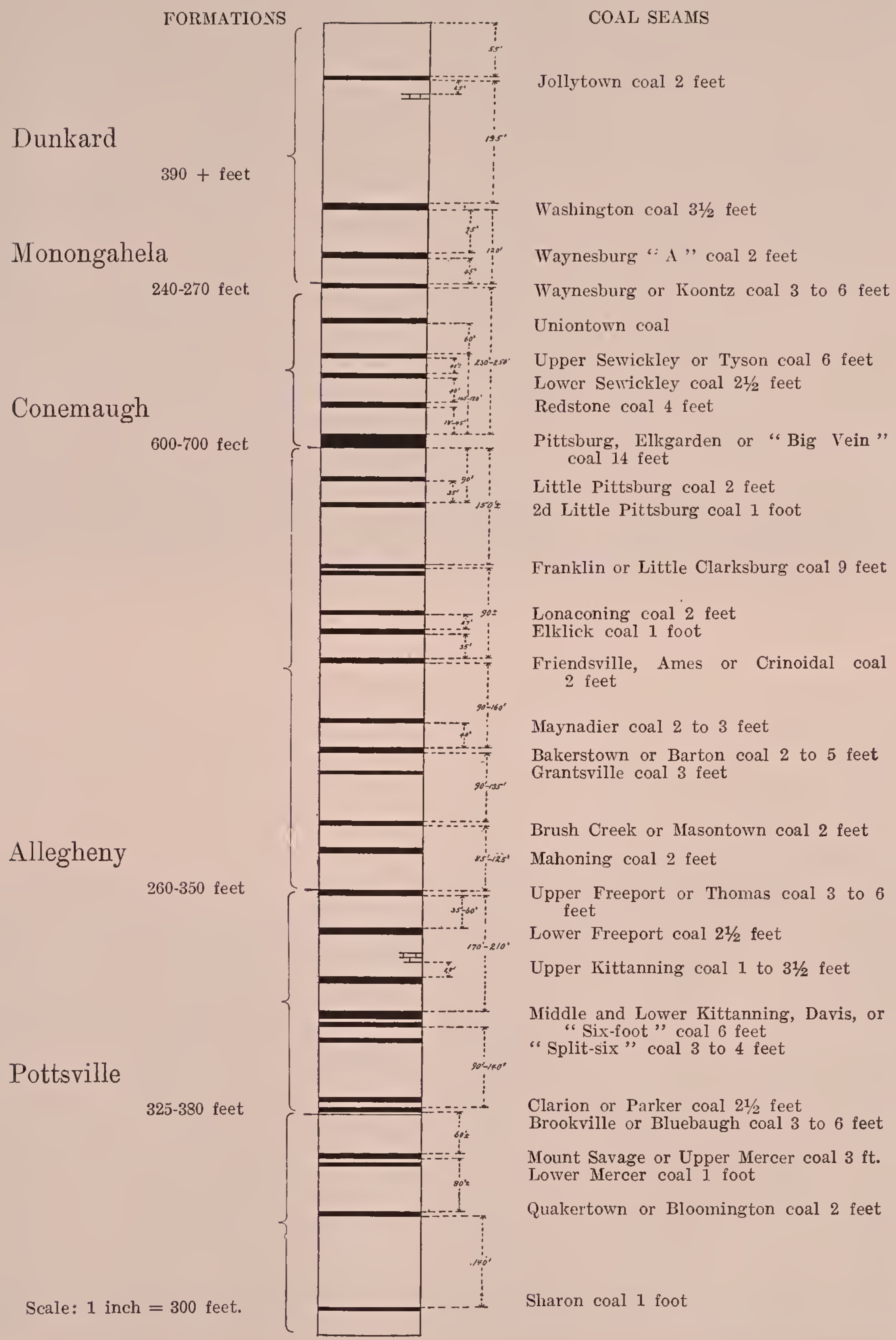

FIG. 7.—Generalized section showing relative positions of Maryland coal seams.

Although coal was discovered in the Georges Creek basin as early as 1782, the first eastern shipments from the Maryland coal district were not made until 1830, when small amounts were transported by barges down the Potomac River. The first company was incorporated in 1836. Since the construction of the Baltimore and Ohio Railroad in 1842 and of the Chesapeake and Ohio Canal in 1850, the output from the Maryland mines has very rapidly increased, and more than 30 companies are now engaged in the mining of coal.

The average value of the output of the Maryland coal mines in recent years has amounted to $5,500,000 annually.

Building Stones.

The rocks of the State of Maryland present many varieties of excellent building and decorative stones. The greatest amount of the product is obtained from that portion of the State north of Washington and east of Harper's Ferry, West Virginia, which has been termed the Piedmont Plateau, and which includes some of the oldest rocks found in the State. The central location of this area, traversed by two main railroad lines and several local ones, places it within convenient distance of the prominent cities and towns of the Middle Atlantic coast and renders the products both valuable and available wherever the local conditions are otherwise favorable. Counteracting the value of this central location, however, is the fact that the State of Maryland represents but a section across a series of geological formations, which are present in Pennsylvania and Virginia, where there are offered similar opportunities for quarrying building stone. In some instances operations were commenced in these areas earlier than in Maryland, with the result that trade has been diverted to neighboring States which might be gained for Maryland by more energetic and intelligent action on the part of the local operators. At the present time the operations in the area are in no wise commensurate with the supply of material at hand, and the demand which might be developed if sufficient forethought and care were expended to make the output uniform and the quarrying economical.

The rich variety in the rocks adapted to structural and decorative purposes renders a description of each variety out of the question, and it becomes necessary to treat the occurrences under the following heads: The Granites and Gneisses. The Marbles, Serpentines, and Limestones. The Quartzites and Sandstones. The Slates.

THE GRANITES AND GNEISSES.

Granite is the broad family name that is applied to a large and common group of rocks, which are usually of a somewhat mottled light gray color, and almost always carry two minerals, quartz and feldspar, as

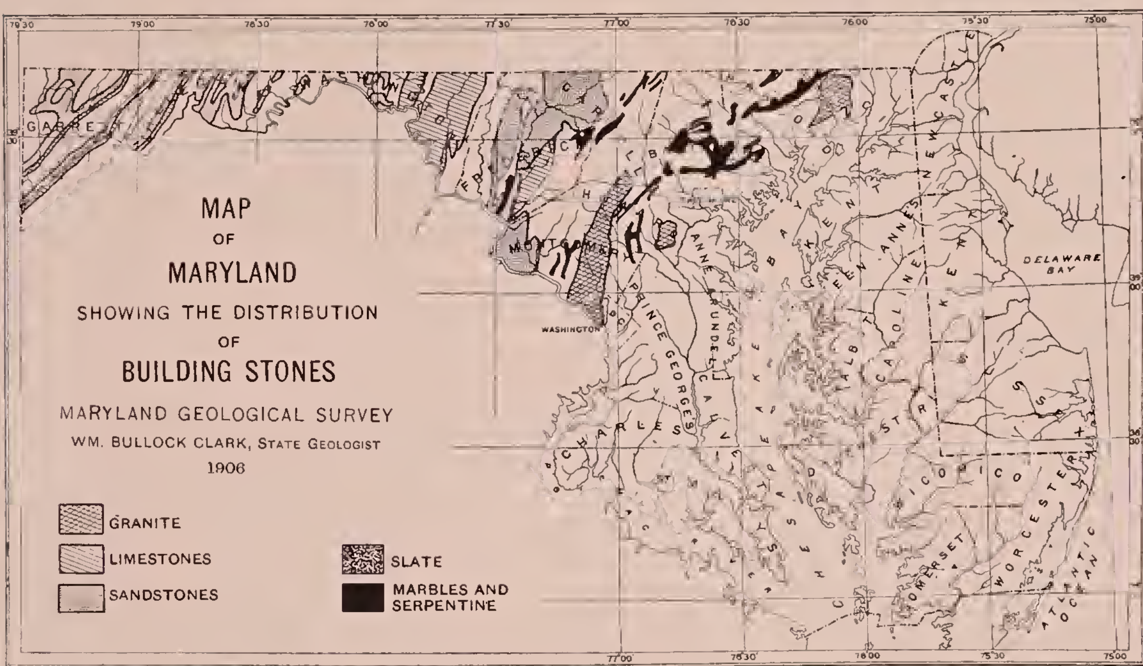

Fig. 8.—Map of Maryland showing the distribution of building stones.

essential constituents. Beside these, which make up the mass of the rock, there are dark colored iron-bearing minerals, such as black mica, or biotite, hornblende, and occasionally pyroxene. Each of these may be evident to the eye without the aid of a lens.

The foregoing minerals usually form irregular aggregates, in which the individual grains interlock in such a way that the cohesive strength of granite is relatively high. The constituent grains vary very widely in size, from individuals two or more inches in diameter to those which are scarcely separable with the unaided eye. The arrangement of the different mineral grains is irregular and without any prominent lines of distribution, when the granites are unmodified products of crystallization from a molten state. Subsequent action on the rock, however, through pressure or recrystallization, generally arranges the constituent minerals in some regular order, such as in parallel or wavy interlocking lines. It is in this way that many granite gneisses originate from granites, as at Port Deposit. True gneisses, however, usually result from the recrystallization of rocks laid down under water, and still retain their banded character. Since in the trade granites and gneisses compete for the same work, and since, when well sorted, there is little difference in their practicability for building purposes, they will be treated together in the present discussion, the differences between the two being shown in the order of grouping in the discussion of the principal quarries.

The regions in Maryland where the granite and gneiss are most extensively worked are at Port Deposit, in Cecil County, in the vicinity of Baltimore, at Woodstock in Baltimore County, and at Ellicott City and Guilford in Howard County. Other areas in Howard and Montgomery counties and in the District of Columbia contain some good stone, but it is there quarried only for local use.

Granites.

PORT DEPOSIT.—The Maryland granite which is perhaps best known outside of the limits of the State is that quarried in the vicinity of Port Deposit. This town is situated on the Susquehanna River three miles above its mouth at Havre de Grace. It is one of the principal towns of Cecil County and has good railroad connections with Philadelphia, Baltimore, Washington, and Harrisburg. It is possible also for light crafts to ascend the Susquehanna as far as the town and receive their loads directly from the quarry. The value of the granites of this area was early recognized, and the rock was used by the settlers for the foundation of some of the oldest colonial dwellings. The industry arising from the quarrying of the rock is, however, of somewhat later origin.

The Port Deposit granite is cut by several series of joints or parting planes which are so situated as to greatly facilitate the extraction of blocks of any desired size. Texturally the stone is marked by an indefinite lamination indicated by the shreds and flakes of blaek miea. In color the rock is a light bluish gray whieh in buildings gives a bright, fresh appearance at first, and then gradually beeomes somewhat darker through an aecumulation of the dust and dirt of the atmosphere. Such a darkening produces a mellowed tone in the buildings which gives a pleasing effect. Chemically and physically this granite is very durable. The chemical and mineralogical analyses show no eonstituents easily removed by the weather, while the tests on its crushing strength (over 20,000 pounds per square inch), its absorption (0.19-0.25), and freezing thoroughly establish its durability under any circumstances to which it may be subjected.

Near Frenchtown, a few miles south of Port Deposit, is another body of granite similarly situated. Here the rock is of the same general character, but the small quarry opened in it has never been very highly developed. Other masses of similar granite, less favorably situated for commereial purposes, may be found on either side of the Susquehanna in the neighborhood of Port Deposit.

ELLICOTT CITY.—The Ellicott City granite area consists of an irregular L-shaped mass, which has an extreme length of about five miles in an east and west direction and a breadth varying from one-half to two miles. The quarries of Ellicott City are located on either side of the Patapsco River in Baltimore and Howard counties, and the rock in which they occur extends on the eastern side of the Patapseo as far east as Ilchester, but on the western side only as far as Grays Siding. The material on the Baltimore County or eastern side is a fine-grained rock with a decided foliation or gneissic structure. On the opposite side of the river in Ellicott City itself it is more uniform and granitic. Here it also has a porphyritic structure in consequence of the development of large flesh-colored crystals of feldspar which are disseminated somewhat irregularly through the rock. The time of opening these quarries dates back probably into the last of the eighteenth century, but the details of their development are entirely wanting.

The opportunities for shipment and drainage are good. Those of the Ellicott City quarry are seldom excelled, as the opening is in the side of a hill so close to the tracks of the Baltimore and Ohio Railroad (main stem) that cars may be loaded simply by turning the derrick boom.

Probably no area of granite within the State shows as great variation in the texture and character of the rock as that about Ellicott City. In the quarries on the eastern side of the river the rock appears quite schistose and homogeneous, and practically lacking in porphyritic crystals. Through it are scattered large patches or segregations of the darker minerals, which give to the rock the somewhat somber effect displayed by the Baltimore Cathedral. These patches do not weaken the rock, though they render the stone less attractive. On the other side of the river the stone has a distinctly porphyritic character, which gives to it a mottled effect. The increased amount of feldspar brightens the rock and the distribution of the crystals adds detailed variety to the structure in which it is used.

Woodstock.—Perhaps the best granite in Maryland for general building purposes is that which is found in the small area in the southwestern corner of Baltimore County near the railroad station of Woodstock, Howard County. Within this area, near the quarries, is the small town of Granite, which was formerly known as Waltersville. The granite mass forms a more or less oval, isolated area extending scarcely two miles northeast and southwest and a mile northwest and southeast. Although so small, it is one of the most important economic areas within the State. The most striking feature of these quarries is the sharp demarkation of the systems of vertical and horizontal joints which are so prominent and so regular as to give the impression of cyclopean masonry.

The chemical composition and appearance of the rock are very satisfactory, and the physical tests on the crushing strength (20,000 pounds per square inch), absorption (0.23-0.25), and freezing show the rock to be all that could be desired for strength and durability.

Guilford.—Perhaps the most attractive granite found within the State is that which is quarried at Guilford, Howard County, about five miles northwest of Annapolis Junction, on the Little Patuxent River.

This granite early attracted attention because of the uniformity and fineness of its grain, its light color, and pleasing effect. Although the area furnishes excellent monumental and building material, it has until the recent construction of a spur been situated some miles distant from the Baltimore and Ohio Railroad, a circumstance which has delayed such a development and recognition of the rock as the material deserves.

Minor Areas.—Besides the five areas already described there are several other granite masses within the State, as indicated by the map, which have been worked from time to time to supply the local demands, and occasionally with the hope of bringing the stone into commercial importance. Of these smaller masses which have been quarried spasmodically may be mentioned those at Dorsey's Run, between Ellicott City and Woodstock; at Sykesville; at Garrett Park; at Cabin John, in Montgomery County; and the granites of the Middletown Valley.

Gneisses.

Certain of the more uniform and compact gneisses furnish good building material and many quarries have been opened in the areas where the demand is great and the expense of handling and transportation is fairly low. These quarries are especially noticeable in the vicinity of Baltimore, where all of these conditions are fulfilled. The gneisses of the area, represented on the map, show great constancy in their mineralogical and textural composition. They are composed of alternating bands of fibrous to micaceous hornblende, biotite and chlorite schist between lighter colored more or less feldspathic quartzschist. The dark ferruginous bands break down readily and are not used at all as structural material, but are discarded as waste. The best material comes from those portions of the lighter bands which are composed almost wholly of quartz, the prepared blocks differing but little from those made of a well-characterized quartzite. The rocks are rather strongly bedded in slabs from three inches to three feet in thickness, and are thus more easily worked than the hardness of the rock might at first suggest.

The quarries about Baltimore are grouped around two centers, Jones Falls and Gwynns Falls, on the northern and western sides of the city,

FIG. 1.—VIEW OF McCLENAHAN GRANITE QUARRY, PORT DEPOSIT, CECIL COUNTY.

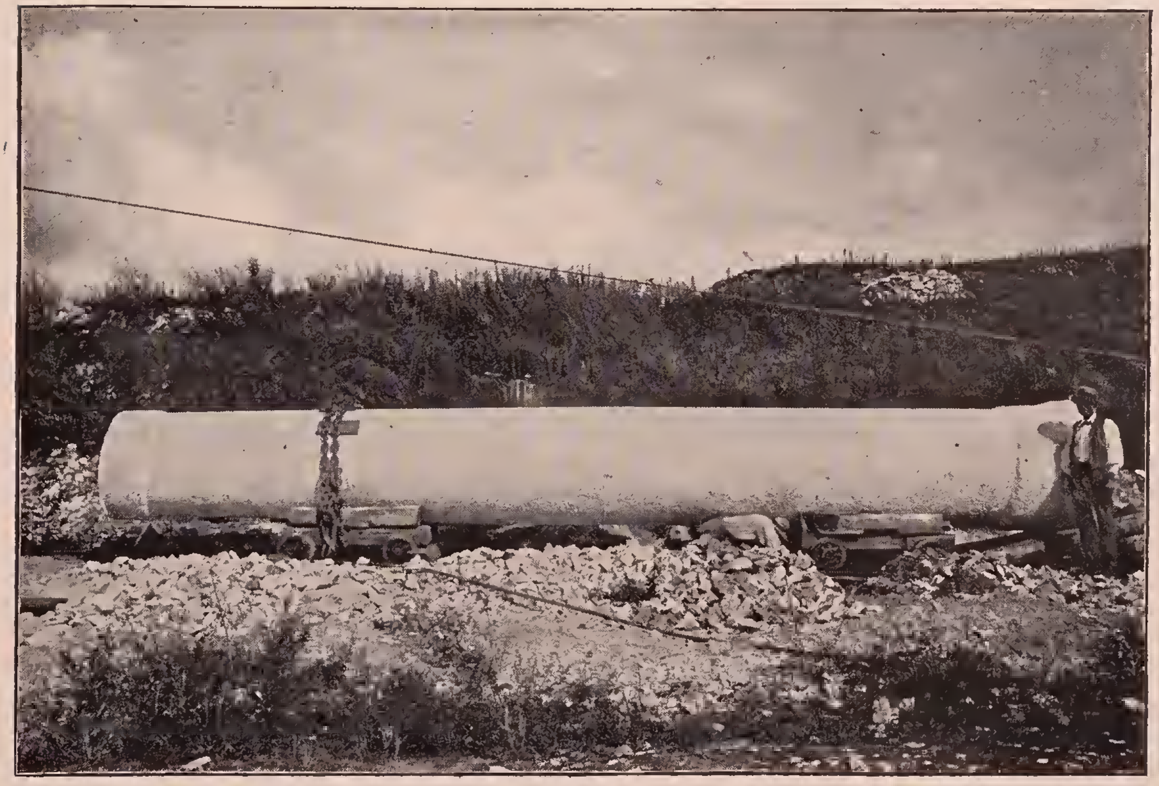

FIG. 2.—THIRTY-EIGHT-TON MONOLITH, BEAVER DAM QUARRY, BALTIMORE COUNTY.

VIEWS OF MARYLAND BUILDING-STONE INDUSTRY.

the location being determined by the facilities afforded by the shape of the country for opening and working the quarries on a horizontal plane. This method of working decreases the cost of handling the stone, avoids any expense or difficulties because of water, and often furnishes a convenient and cheap dumping ground away from the rock bed which may be worked in the future.

Smaller quarries are found at different points within the Piedmont where the gneiss is worked to meet the local demand for foundations, crushed stone, etc.

The average value for the annual output of granites and gneisses in the State is about $800,000.

THE MARBLES AND LIMESTONES.

The marbles and limestones are perhaps the most uniformly distributed of all the building stones in the State, for larger or smaller areas may be found in Baltimore, Carroll, Howard, Frederick, Montgomery, Washington, Allegany, and Garrett counties. These differ widely, however, in character, mode of occurrence, and geological age. Unlike the granites, gneisses, and serpentines, they are not confined to the central portion of the State, called the Piedmont Plateau, since they are found well developed in the broad Hagerstown and Frederick valleys and in the more mountainous areas of the Alleghanies. The exposures are almost always poor on account of the relative readiness with which these rocks break down under atmospheric agencies, and from the same cause they usually occur in valleys and seldom along ridges or the crests of mountains, as the sandstones do. Moreover, whenever there occur sufficient bodies the valleys are characteristically broad, flat, and very fertile.

According to their geological age the marbles and limestones have undergone various degrees of change, since the time of their formation. There is a progressive increase in their crystalline character and freedom from fossils, from the little changed fossiliferous Greenbrier limestones of Garrett County to the crystalline, non-fossiliferous marbles of Baltimore County. This increased alteration, which they have undergone, is accompanied by a change in color from the dark limestones of the Carboniferous and Helderberg formations through the lighter Shenandoah limestones to the variegated marbles of the western Piedmont formation and the clear white or blue marbles which are so extensively worked in Baltimore County.

According to their character, their occurrence, and the uses to which these various stones are put, they may be grouped for discussion in the following subdivisions:

Marbles, including the highly crystalline dolomites and marbles of Baltimore, Howard, and Carroll counties.

"Potomac Marble," or breccia, which is found locally in the "Red beds" of the Newark formation (Triassic) in Montgomery, Frederick, and Carroll counties.

Serpentines or "Verde Antique" of Harford, Baltimore, and Montgomery counties.

Limestones, including the crystalline blue and gray limestones, magnesian limestones, and "dolomites" of Frederick, Washington, Allegany, and Garrett counties.

Marbles.

The marbles of Maryland have been known for their great value in building and monumental work since the beginning of the last century. They are all confined to that portion of Maryland composed of the highly crystalline rocks of the Piedmont Plateau. Those which are being worked at the present time occur in Baltimore County.

MARBLES OF BALTIMORE COUNTY.—The chief quarries are located at Cockeysville and Texas, on the Northern Central Railway, about fifteen miles from Baltimore, and are separated from each other by a distance of a mile and a half. Although situated so close together and presenting but parts of a single formation in the same valley, the quarries expose rocks showing many differences in composition, purity, coarseness of grain and texture, which have developed different industries in the two places. The rock at Texas is a coarse-grained marble of nearly pure carbonate of lime suitable for use as a flux or fertilizer, while that at Cockeysville is a finer-grained dolomitic marble, rich in magnesium and well adapted for building and decorative purposes.

The *texture* of the eastern marble varies widely. The rock from Texas is a very coarsely crystalline marble or "alum stone" in which the individual grains are sometimes $\frac{1}{2}$ or $\frac{3}{4}$ of an inch in diameter. The constituents are weak in themselves and they are weakly held together. Such a texture renders the rock nearly worthless as a building stone where small blocks must be used and great weights sustained. This is emphasized by the determination of the crushing strength, which is very low. The grain of the Cockeysville or "Beaver Dam" rock, on the other hand, is excellent, the individuals seldom exceeding $\frac{1}{16}$ of an inch in diameter, the component particles forming a closely interlocking aggregate. This interlocking of the grains tends to produce a compact and hard rock whose crushing strength is high (20,000 pounds) and absorption ratio low (0.213 per cent). This difference in closeness of grain is not strictly a geographical one, since fine-grained marbles, similar to those at Cockeysville, may be found at Texas. There is at the latter point, however, little evidence of the occurrence of rock which will combine such fineness and closeness of grain, freedom from mica and pyrite, and abundance as is shown in the rock worked by the Beaver Dam Company at Cockeysville. Quarries are also being opened at Summerfield, where good deposits of marble have recently been found. Small areas of marble also occur in Howard County.

MARBLES OF CARROLL COUNTY.—Intermediate between the clear white, fine-grained saccharoidal marbles of Baltimore and Howard counties and the dark blue and gray limestones of the Hagerstown and Frederick valleys are the variegated marbles of Carroll County, which have furnished samples unsurpassed in beauty and variety by those of other states. All of these varieties occur in lenses which do not occupy any considerable extent or present large exposures, but instead are confined to valleys which are long and narrow and are the direct result of the readier removal of the calcareous rocks than of the adjacent shales and sandstones. The marbles thus occupy the bottom lands and seldom outcrop high above the level of the streams.

Up to the present time the method of extracting the stone has been very crude, since the only desire has been to obtain the rock in pieces suitable for foundations and ordinary buildings. From a study of the small quarries it seems probable that no blocks can now be obtained in size, shape, and quantity for first-class building purposes. The jointing is not trustworthy and the rock tends to break down into thick angular blocks varying in size from eight cubic feet to small fragments. Careful work with channeling machines or diamond drills and a discontinuance of explosives might allow the quarrying of blocks which would be valuable for interior decoration in the form of mosaics and mantels.

Another serious drawback in working these rocks, which appear so beautiful in samples, is the irregular distribution of the colors. The white may be replaced by red or the red may be replaced by blue and so on. There seems, however, to be a greater amount of red and white or clear white than anything else. The variations in color are so frequent and uncertain that it seems doubtful if any quarry now opened could fill any moderately large order with material like a given sample. That there are beautiful marbles within these lenses is beyond doubt, but a suitable place for the development of a profitable industry in them has yet to be found.

Potomac Marble.

The most interesting building material in the entire State of Maryland is the "Potomac marble," "calico rock," or "Potomac breccia," which has been used occasionally for the greater portion of a century. The chief interest in this rock arises from the fact that, as stated by Merril, it is "the only true conglomerate or breccia marble that has ever been utilized to any extent in the United States."

This conglomerate is found in several places along the eastern slope of the Blue Ridge and has been quarried near Washington Junction on the Baltimore and Ohio Railroad. The quarries are small affairs, which have been operated spasmodically. The one most actively operated is located about a mile east of the Washington Junction station.

This rock was first brought into notice by Mr. B. H. Latrobe, Superintending Architect in the construction and repair of the Capitol and White House before and after the War of 1812. The columns which were then procured are still standing in the old House of Representatives, now used as Statuary Hall. The quarries whence they were obtained have never been fully developed, although Mr. Latrobe thought that he had found in the newly discovered marble of the Potomac an inexhaustible resource of the most beautiful building materials easily accessible by water. The conglomerate consists of pebbles of limestone of varying size which sometimes reach a foot in diameter, although usually averaging about two or three inches. The fragments, which are both well rounded and angular, range in color from gray to blue and dark blue, and occasionally pebbles of quartz, chloritic schist, and white crystalline marble occur. All are imbedded in a red calcareous matrix mixed with a greater or less amount of sand.

Serpentine.

Serpentine or "Verde Antique" has been quarried in Maryland for many years, but the annual production has always remained small. As this rock enters into competition with some of the marble for interior decoration it has frequently been classed as a marble, although as far as the Maryland deposits are concerned it is in no wise related to the marble, however intimately interwoven with calcite veins it may be. The deposits are found in Cecil, Harford, Baltimore, Howard, and Montgomery counties, where they have been worked to a greater or less extent in the hope of obtaining good material for general building or interior decoration. The most thoroughly exploited are those about Baltimore, at the Bare Hills, those on the banks of Broad Creek in the eastern part of Harford County, and a small area near Cambria in the northern part of the same county. That the stone is capable of furnishing beautiful slabs for decorative purposes has been clearly proven. The deposits on Broad Creek are situated in the midst of a large serpentine area, which extends from the Susquehanna southwesterly into Baltimore County. The nearest town is the small village of Dublin some three miles to the south, which is lacking in both railroad and canal communication. In the shipping of orders it is necessary to have all of the stone hauled to Conowingo on the Perryville and Columbia Railroad, a distance of three or four miles. The texture of the stone does not vary widely, and the impression is left that the stone works readily. If due care is used to avoid the use of explosives and the working of the stone after it has lost the so-called quarry water, much of the waste may be avoided. The use of diamond drills or channeling machines offers the only method which will justify the expectation of profitable work.

What has been said of the Broad Creek rock may equally well be said of that in the smaller openings near Cambria, a small station on the Baltimore and Lehigh Railroad not far from Cardiff.

The average value of the annual output of marble and serpentine in the State is approximately $100,000.

Limestones.

The blue and gray limestones of Paleozoic age have with a single exception never been quarried in Maryland as building stones except for local use. The most important and in fact the only limestone which has been used in prominent buildings is the Shenandoah limestone of the Hagerstown and Frederick valleys. This rock is a magnesian limestone containing alumina and graphite which, however, shows a wide range in its composition.

This stone is usually of a deep blue color when freshly quarried but upon exposure there is slowly formed a thin white coating over the face of the rock, which brightens the color to a dove-gray, thereby greatly improving the appearance of the buildings. This change goes on uniformly and accordingly does not pass through the unsightly mottled stage.

There is no doubt that this rock might become of considerable importance commercially as a building stone. At present, however, the residual soil, with which it is covered, lends itself so readily to brick making that there is little demand for stone except in heavy structures or for foundations.

Many areas in the Hagerstown Valley offer limestones which may ultimately prove of importance as building stones. Openings in the rock are made only for lime at the present time, and the methods of quarrying, which shatter the rock by heavy charges, make the exposures look less favorable for the production of building stone than is actually the case. If proper care in extraction were exercised, there is no doubt but that large blocks of limestone could be quarried in many places throughout the entire valley, which would in some instances work into a good grade of "black marble."

The most successful quarry at the present time is that situated near Eckles Mills, Washington County, operated by the Washington Marble Company. The rock, as here exposed, occurs in several well-defined beds, lying at a moderate dip, which yield excellent decorative stock. The material varies somewhat in color in the different beds but large slabs, suitable for interior decoration, have been obtained, which in their soft, pleasing tones and agreeable markings rival many of the better known foreign marbles. The product of these quarries is already on the market and the present demand forecasts the establishment of a good industry at this locality.

In the Frederick Valley little has ever been done towards quarrying the blue limestone for building purposes, as almost all of the stone which has been taken out has been burned for lime which finds a ready market. The buildings in Frederick show that there has been some quarrying for building material, since several of them are built of limestone and almost all of them have limestone foundations or sills.

West of the Hagerstown Valley in Washington, Allegany, and Garrett counties there are three Paleozoic limestones, namely the Niagara, Helderberg, and Greenbrier. Of these the second is the only one which offers reasonable grounds for expecting good building material within its limits. The upper massive beds of the Helderberg which outcrop in five or six small bodies along the Potomac from Hancock to Cumberland, and form a continuous belt from the latter point to Keyser, West Virginia, afford every indication that satisfactory building material may be obtained. Little if any work has been done in this formation because there have been no local demands.

Of the two remaining formations the Niagara is of such a nature that it cannot be used at all, and the Greenbrier is scarcely any better adapted to building purposes. Both formations occur in valleys with very few outcrops. The latter division has a single exposure on the Potomac between Keyser and Piedmont, West Virginia, and is imperfectly shown on Jennings Run and Braddocks Run. It is also injured for structural purposes by the pyrite which occurs scattered through it.

The average value of the annual output of limestone for the State is approximately $100,000.

THE SANDSTONES.

Although there is but one sandstone within the State which has attained any considerable reputation as a building stone, there are many formations in different parts of the area which furnish suitable sandstones for local construction. As is the case with all building stones the factor of transportation facilities is so important that only those deposits can come into general use which are high class and situated adjacent to prominent lines of travel either by railroad or boat. The sandstones of the State may be considered under the following heads: the *Triassic sandstones,* the *Paleozoic sandstones* including the Cambrian or "Mountain" sandstone, the Tuscarora and Oriskany sandstones, the Pocono and Pottsville sandstones, and the *Micaceous sandstones.*

Triassic Sandstones.

The Triassic or "Seneca Red" sandstones are the only ones quarried in Maryland which possess a recognized reputation in the market, or which furnish material for more than local work. The formation in which they occur is extensively developed along the eastern edge of the United States from Connecticut southward through New York, New Jersey, Pennsylvania, and Virginia and in scattered areas into North and South Carolina. It is from rocks of the same age that the well-known building stones from Portland, Connecticut, Prallsville, New Jersey, and Hummelstown, Pennsylvania, are quarried. This formation enters Maryland from the north near Emmitsburg, and continues with varying width through Carroll, Frederick, and Montgomery counties to the Potomac River. Between these limits there is an almost continuous belt locally known as the "red lands" which is divided into two areas by a small exposure of the underlying Shenandoah limestone a few miles west of Frederick, where the whole of the Triassic has been removed by stream erosion.

In either direction from this point the formation widens to about 16 miles at the Mason and Dixon Line and 4 miles where it crosses the Potomac. East of this belt in the southwestern corner of Montgomery County there is also a broad area of the same formation which is continued southward into Virginia. It is to this southern area that the quarrying of sandstone is almost entirely confined. The prominent quarries are situated near the mouth of Seneca Creek, Montgomery County, on the Chesapeake and Ohio Canal about 25 miles northwest of Washington.

The first use of the Seneca stone is not known, although it is evident that blocks of this material were utilized prior to the Revolution. The beds from which the building stones are now obtained lie west of Seneca Creek, on the left bank of the Potomac River, where the dip is some 15 to 20 degrees to the southwest. The sandstone beds themselves differ very much, not only in color but also in hardness and texture. Some are fine-grained and can be wrought to a sharp arris, others are coarse-grained and may assume the character of a conglomerate. Interstratified with these grits are argillaceous shaly beds, which, together with some of the conglomeritic beds, are entirely unfit for the better grades of work, and cannot compete even with local stone for rough foundation work on account of the cost of transportation. In strata showing as wide variation as these do it is natural that only a portion of the material excavated is available, and there must necessarily be a considerable waste.

The texture of the stone which is placed upon the market is exceptionally good. It is very fine-grained and uniform and is not at all shaly, and shows little or no disposition to scale when exposed to the weather. The particles of quartz are evidently distributed through a fine, scarcely perceptible cement, and over the entire face there are very minute flakes of muscovite which brighten the general appearance of the rock. Occasionally in larger blocks there are seen small bands of coarser grain which indicate the bedding, and in a few instances this alternation in texture is emphasized by variation in the color of the cement.

One of the most valuable features of the Seneca sandstone is the extreme readiness with which the stone may be carved and chiseled when it is first quarried. It is then soft enough to be easily cut and the texture is sufficiently uniform to render the stone satisfactory for delicate carving. As is frequently the case with all building stones the rock after exposure loses the readiness with which it may be worked and becomes hard enough to turn the edge of well-tempered tools. It is this hardening on exposure which protects and preserves the delicate tracery sometimes seen in the finer examples of dressing in blocks from these quarries.

The color of the Seneca Creek sandstone as furnished varies from a homogeneous light reddish-brown or cinnamon to a chocolate or deep purple-brown. When freshly quarried the colors are even brighter than after the rock has been exposed some time, the rock presenting tones of a light reddish fawn color. The color changes with the composition. With an increase in quartz the luster of the rock becomes brighter and with an increase in feldspar the tone of the rock becomes grayer, while an increase in the amount of cement deepens the color.

Throughout the entire extent of the Triassic as exposed in Maryland there are small local quarries developed to supply the demands for foundations and occasionally for more pretentious buildings. The general demand, however, is more than overcome by the cost of transportation in all but the most favorably situated localities. There are, however, many occurrences which will prove of value as the country becomes developed and improves its facilities for distributing its resources.

Paleozoic Sandstones.

Among the various Paleozoic formations there are five well-marked sandstones. These are the Cambrian, Tuscarora, Oriskany, Pocono, and Pottsville. None of these have been worked to any considerable extent as building stones, because of the lack of demand and of transportation facilities.

CAMBRIAN or "MOUNTAIN" sandstone extends across the State in two parallel bands of dense quartzites which form the Blue Ridge and Catoctin mountains. These quartzites were originally porous sandstones, which have subsequently been thoroughly consolidated by a dense silicious cement. Similar rocks also occur in the small detached area of Cambrian sandstones which forms Sugar Loaf Mountain. The rock has never been brought prominently into the market, although it has been used quite extensively for railroads, canals, roads, and a few individual buildings.

Other quarries have been opened in a small way along the Western Maryland Railroad to supply the demands for good road metal and small quarries have been operated as at Emmitsburg.

TUSCARORA and ORISKANY sandstones have a considerable development in Allegany and Washington counties where the stone has been used to supply the local demands. This is especially true of the area about Cumberland. Here the Oriskany sandstone, which is of a buff-brown to yellow color, was the first to be introduced. It is the source of all the sills, foundations, and lintels for the older buildings. Although this has not proved altogether satisfactory about Cumberland there are other points in the distribution of this formation where it seems probable that good material may be obtained.

When it was found that the Oriskany sandstones were not as durable as expected and that they soon became disfigured by exposure, attention was directed to the harder white sandstones of the Tuscarora which are exposed in Wills Mountain just west of Cumberland. The ledge as here exposed has a thickness of some 300 feet, but the solid rock has not yet been quarried since the demand is more readily supplied by utilizing the many detached blocks which cover the slopes of the mountain. At the present time this stone is used for foundations and trimmings in all of the better class of buildings in Cumberland. The rock varies somewhat in texture and firmness according to the different beds, but on the whole shows unusual uniformity. It is bright gray in color and is composed entirely of fragments of quartz, which are themselves cemented by a silicious cement, causing the rock to be in reality a quartzite rather than a sandstone. Feldspar and mica are also found in the rock. Few imperfections were noticed and for one of such silicious character the rock seems to be very free-working.

POCONO sandstone has received but little attention and has been used only occasionally as a supply for flagging. It seems quite probable that as the demand for building stones increases the flags, which are well developed in places, may come to be of some importance.

POTTSVILLE sandstones and conglomerate are interstratified with sandy shales in which thin beds of coal are locally developed. The sandstones are usually coarse-grained and conglomeritic, with marked evidences of cross-bedding which are irregular in extent and distribution. The individual pebbles, frequently very small, are held together by a silicious cement, which indicates great durability for the rock. Unfortunately such a cement renders the working of the stone both difficult and expensive. It is probable that this material will never become of economic importance except in the supply of local demands for foundations, steps, and occasional door sills.

Micaceous Sandstones.

Scattered over the northeastern portion of Maryland in Baltimore and Harford counties are several exposures of highly micaceous quartzose rocks, which were originally sandstones but which have now undergone considerable change through dynamic metamorphism. These are most characteristically developed in Setters Ridge along the Green Spring Valley, ten miles north of Baltimore where the rock is quarried near Stevenson.

The average annual output of sandstones for the State is approximately $25,000.

THE SLATES.

Slate suitable for the production of roofing-slate has been found at several points within the limits of the State and quarries have been opened in the Peachbottom area of Harford County, at Hyattstown in Montgomery County, and at Linganore and Ijamsville in Frederick County. Slates from the latter county have proved pleasing in color and durable, but the public taste has been educated to certain characteristics for slate which these do not possess and they are of little or no commercial importance. The only area of active operations at present is that in Harford County.

The Peachbottom Slates.

The slate produced in the quarries of the Peachbottom district of Maryland and Pennsylvania is the most widely known structural material manufactured within the limits of the State. Unfortunately Maryland has received little credit for its share in the industry although almost all of the productive quarries are situated within its limits. This apparent injustice has arisen from the fact that the shipping point for most of the quarries and the residence of many of the operators is Delta, Pennsylvania, a town lying at the foot of the ridge which supplies the stock for the manufacture of slate. Delta is much larger and better known than its Maryland associate, Cardiff, which is only separated by the State boundary.

The topographic relations between the town and the quarries are particularly favorable for the shipment of slates and the establishment of a prosperous community. The town is connected with the principal cities of the Atlantic seaboard by the Maryland and Pennsylvania Railroad reaching from York, Pennsylvania, to Baltimore. There is no information at hand from which we may learn when the presence of valuable roofing slates was first recognized in this area or when the first material was taken out for roofing purposes. According to the local tradition, which is subject to some doubt, the slates were quarried as early as 1750. The building on which these slates were laid was destroyed a few years ago and the inferences concerning its age are based on a series of deeds and family papers which seem to indicate the date of construction as 1749 or 1750 and the source of the material as some point on the ridge not far to the north of the Mason and Dixon Line.

The first authentic evidence of quarrying is the slate recently removed from the roof of the old Slate Ridge Church, known to have been built in 1805, which was torn down in 1893. The slates from this old roof which had been exposed to the atmospheric agents of degeneration for nearly a hundred years show no change in color or firmness, although some of them were covered by lichens and other vegetable growths. Some of the larger slabs have been preserved by the quarry superintendents to show the great stability of their stone, even when poorly prepared and poorly laid.

Throughout all of that part of the area which has furnished good slates the bedding is not clearly defined and the ledges of first-class material do not seem to present any continuous arrangement, suggesting valuable beds separated by non-productive ones. This lack of definition in the bedding of the stone renders it impossible to compute with any degree of accuracy the thickness of beds or "veins." Some of the quarries produce good slate over a distance of at least 150 feet across the strike and their operations are limited not by the quality of the stone but by a short-sightedness during early operations which allowed the rubbish to be dumped upon the workable beds.

All of the quarries along the line show a great many series of joints which both aid and hinder the working of the quarries. The great number of joints and their intersection with each other at varying angles renders much of the material extracted unavailable for the manufacture of roofing slates or mill stock. While this is so and the amount of rubbish about the quarries is very great it is doubtful if there has been a greater portion of waste material than is common in slate quarries the world over.

The most prominent feature in the texture of the Peachbottom slates is the coarse fibrous arrangement of the particles which give to the stone an appearance somewhat suggestive of the fiber of petrified wood. This texture renders the slates much stronger in certain directions than they might otherwise be, but precludes the method of breaking the slates by sharp blows applied normal to the cleavage and makes the stock less available for milling purposes. The material prepared for market shows little or no variation in the nature of the stone employed, but the character of the finished product seems to vary somewhat in different quarries. Not only is there a difference in the skill with which the work is done, but the quarrymen seem to differ in the amount of care which they exercise in sorting the first and second qualities.

The color of the Peachbottom slates is a deep blue-black which is absolutely unfading, as is shown by the color of slates which have been exposed since the beginning of the last century. This fact alone marks the product of the area as one of the best slates of the world. From this color there seems to be no variation in any of the well-prepared material. It should be borne in mind, however, that slates, like broadcloths, when placed side by side with their texture in different positions show differences in their sheen and that these differences may become so marked that an impression of a variation in color is often given. The unfading quality of the Peachbottom slates allies them with the products of the Maine and certain of the Vermont quarries and separates them from the less uniformly colored slates of the Lehigh and Slatington districts which are not always able to retain their color unmodified by exposure.

The average annual output of slate for Maryland is approximately $125,000.

THE CLAYS AND CLAY PRODUCTS.

The clays of Maryland that are suitable for economic purposes are widely distributed and occur at various geological horizons. They are most widely distributed throughout the eastern and southern portions of the State although some of the most important clays occur in the central and western counties. The clays of Maryland are suitable for common brick, fire-brick, enameled-brick, stove-brick, terra cotta, sewer-pipe, tile, and pottery.

COMMON BRICK CLAYS.

Clays suitable for the manufacture of common brick are widely distributed throughout the State. Brick making began in southern Maryland in colonial days, scattered references to the industry being found in the earliest records. It is evident that practically all of the common brick employed for building purposes in colonial days was made at the local brick yards.

Maryland common brick is made from three types of deposits, viz., the Coastal Plain sedimentary clays, the residual clays of the Piedmont Plateau, and the shaly deposits of the Appalachian Region.

Clays suitable for the manufacture of common brick are found everywhere throughout the Coastal Plain. The Columbia loams of Pleistocene

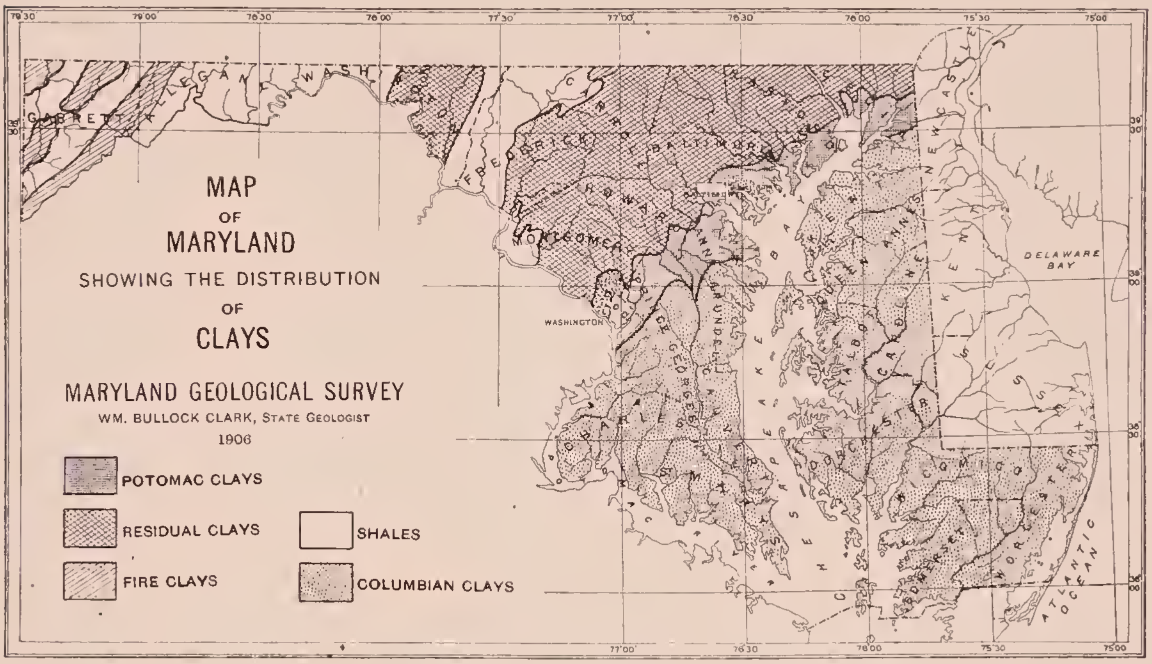

Fig. 9.—Map of Maryland showing the distribution of clays.

age form a mantle over most of the surface of the district and on account of their grittiness and ferruginous character are excellently adapted to the manufacture of common brick and are widely used in the vicinity of Baltimore. They have sufficient iron to burn to a good red color, enough fine particles to insure proper plasticity, and enough grit to prevent excessive shrinkage in burning.

The only Tertiary clay of any great importance for brick making is the Marlboro clay at the base of the Nanjemoy formation. It is common through sections of Southern Maryland and is well suited to the manufacture both of pressed and common brick.

The Lower Cretaceous formations afford important brick clays, the Raritan, however, furnishing chiefly buff-burning clays, although red-burning ones occur. The clays from this formation are best developed in Anne Arundel County. The Patapsco formation which underlies the Raritan contains a large amount of highly variegated clays and extends in a broad belt across the State near the western margin of the Coastal Plain. The clays of the Patapsco formation are more plastic than the Columbia clays and as a general rule occur in beds of much greater thickness. They are particularly well adapted to the manufacture of stiff-mud brick while the Columbia clays are rather too gritty for this purpose. Next to the Columbia clays they are the most important brick clays in the eastern section of the State. They are located for the most part near the head of tide along the leading railroad lines and therefore possess great commercial importance.

In the Jurassic the Arundel formation affords large supplies of iron-ore clays which are well adapted to the making not only of common brick but also of pressed brick. They are moderately silicious, highly plastic, and have sufficient iron to burn to a good red color. At some localities the Arundel clays are comparatively free from iron so they burn buff instead of red and lend themselves well to the production of terra cotta and roofing tile.

The residual clays of the Piedmont region are derived from either gneisses, granites, limestones, or schists, as a general rule, and in almost every case are quite ferruginous so that they not only burn to a deep red product but may do so at a comparatively low temperature. Those which are derived from a basic igneous rock, such as gabbro or peridotite, usually have a very high plasticity and consequently show a high shrinkage in burning. Owing to their high plasticity, however, they generally permit of the admixture of considerable sand, although the manufacturer often has some difficulty in thoroughly incorporating the material with the clay. The residual clays are likely to be variable in their depths owing to the uneven surface of the underlying rock, and consequently they may vary anywhere from 3 or 4 to 25 or more feet in thickness.

The shales suitable for brick making are to be found either in the Devonian or Carboniferous, although up to the present time only the former have been used. With an increase in demand for bricks in the counties of the Appalachian region the Carboniferous shales will no doubt spring into prominence and be opened at a number of points. Many of these shale deposits will also probably be found available for the manufacture of vitrified brick.

TERRA COTTA CLAYS.

The terra cotta industry of Maryland has been comparatively little developed although what has been done is sufficient to show that suitable materials for the purpose are not lacking within the limits of the State. The kinds of materials which have been chiefly employed for this purpose are the buff-burning Arundel clays, the sandy Patuxent clays, and the variegated Patuxent clays. All of these clays are well developed to the south of Baltimore, especially in Anne Arundel and Prince George's counties. At times the variegated Patapsco clay is also well adapted for terra cotta work, particularly in the southern part of Baltimore City.

SEWER-PIPE CLAYS.

The only sewer-pipe clays employed at the present time come from the Arundel formation although it is probable that equally good clays could be obtained from the Pleistocene deposits and from the Patapsco formation. The small importance of the sewer-pipe industry in Maryland at the present time is due rather to trade conditions than to lack of clays for both the Arundel and Patapsco formations yield materials of considerable plasticity.

FIRE CLAYS.

The refractory clays found in Maryland are obtained either from the Coastal Plain formations or from the Carboniferous deposits of the Appalachian region. The Carboniferous fire clays of Maryland have long been well known, the deposits having been worked since 1841. The Pottsville formation is the chief source of the clays which are worked at the present time, chiefly along the eastern flank of Savage Mountain. These Carboniferous fire clays occur in two forms, known as the plastic clay or shale, and the flint clay. Both of them are highly refractory in character.

In the Coastal Plain region fire clays are obtained from the Patapsco, Raritan, and Patuxent formations as well as in some instances from the decayed crystalline rocks beneath. The first three of these formations contain lenses or extensive beds of white to yellow-white clays which frequently show a high resistance to fire and can be heated up to the fusing point of cone 27 without in many cases becoming vitrified.

The refractory-ware industry of Maryland is one of the most important branches of the clay-working industry found in the State. Among the more important products are fire-brick, enameled-brick, retorts, stove-brick, and stove-linings. The fire-brick are made both in western Allegany County and in Baltimore. The manufacture of enameled-brick is confined, however, to the former locality. Retorts are made in Baltimore while stove-brick and stove-linings are largely manufactured in Cecil County.

POTTERY CLAYS.

The pottery clays include materials showing a wide range of composition. The clays suitable for the manufacture of stoneware are to be found at many points in the Patapsco formation, especially in Cecil County. At the base of the Patapsco formation in the same county there is often a bed of bluish-gray, very plastic stoneware clay. Aside from these Cecil County stoneware clays the most important are those outcropping along the shore of the Chesapeake from Bodkin Point southward.

Clays suitable for the manufacture of yellow-ware are to be found at a number of points in the Arundel formation and also in the Columbia, both of these formations being extensively drawn upon by the yellow and Rockingham ware manufacturers of Baltimore.

FIG. 1.—SHALE BANK OF QUEEN CITY BRICK AND TILE COMPANY, CUMBERLAND, ALLEGANY COUNTY.

FIG. 2.—PIT OF WASHINGTON HYDRAULIC-PRESS BRICK COMPANY, HARMAN, ANNE ARUNDEL COUNTY.

VIEWS OF MARYLAND CLAY INDUSTRY.

Clays for the manufacture of the common red earthenware are abundant and are obtained from the Columbia, Arundel, and Patapsco formations of the Coastal Plain and from the residual clays of the Piedmont Plateau northeast of Catonsville, and also from the residual clays of the Appalachian region around Hagerstown. The Potomac clays near Baltimore also afford the basis for the manufacture of the higher grades of pottery.

The clay industry is already an important one in Maryland, the average value of the output in recent years being $1,435,000.

The Porcelain Materials.

Maryland, as a State, is well provided with porcelain materials such as flint, vein quartz, feldspar, and kaolin. These are chiefly developed in central Maryland and mined in this region only. They are abundantly present over wide areas but only occasionally are they sufficiently free from colored minerals and coloring matter to meet the requirements of porcelain manufacture.

FLINT.

The flint or quartz is derived from unusually large and pure masses of vein quartz or from portions of the gneiss and granite along their contact where the original rocks have been reduced to white pulverulent quartz. Flint has been sought most successfully in Cecil, Harford, and Baltimore counties. Most of the material occurs as veins intersecting the country rock, generally gabbro, serpentine, or granite, as in the vicinity of Castleton and along Deer Creek in Harford County. Here and elsewhere where the vein quartz is utilized it is necessary to grind the material to a flour and to facilitate this grinding it is customary to roast the blocks of quartz and then cool them suddenly by pouring on water, as is done at the flint works at Conowingo, Cecil County. The flint from the granite-gneiss contacts require no roasting but need to be ground to a flour to meet requirements. The flint flour is shipped in bags to different points within and without the State, chiefly Trenton, New Jersey, where it is employed in the manufacture of porcelain, crockeryware, wall and sandpaper, scouring soap, tiles, and paints. The annual output for the State varies greatly but does not average over $85,000.

FELDSPAR.

The feldspar, or spar, occurs in pegmatite veins which are found abundantly developed throughout the southeastern portion of the Piedmont in Cecil, Harford, Baltimore, Carroll, and Howard counties. The material mined is either microcline or orthoclase furnishing the so-called "potash spar," or a plagioclase furnishing the "soda spar." The presence of pegmatite dikes in which these minerals occur may be easily recognized by the numerous coarse-grained boulders scattered over the surface or by the chalky white streaks in the road-cuts. They are very frequently found near the borders of the serpentine, gabbro, or granite, and occasionally in the marbles. The valuable dikes are those in which the "spar" is free from colored minerals and relatively free from quartz. Pegmatites of this character are being worked in Cecil County along the Mason and Dixon Line and in the valley of the Patapsco in Baltimore and Howard counties. All of the material has to be hand-culled to free it from ferruginous matter which would stain the pottery-ware during burning and the output is shipped in a crude state chiefly to Trenton, New Jersey, Baltimore, and East Liverpool, Ohio, where it is ground and used in the extensive pottery works. The supply of valuable spar is chiefly limited to the Piedmont portions of Pennsylvania, Delaware, and Maryland. The annual output in this State varies but averages over $10,000.

KAOLIN.

The kaolin, which is generally a residual white clay derived from feldspathic gneisses comparatively free from minerals containing iron, is best developed in Cecil County. The deposits of this region are closely related to those of adjoining portions of Delaware, although in the latter State part of the kaolin is derived from the decomposed pegmatites. The crude kaolin is washed and deposited in settling tanks, the greater part of the fine quartz and staining constituents being removed, and subsequently dried under pressure. The Maryland material is used for fire-clay and sagger-clay but chiefly in the manufacture of paper. The annual value of the output is about $10,000.

THE LIME AND CEMENT PRODUCTS.

The limestone and marble deposits of Maryland have been extensively burned for building and agricultural purposes. In the earlier days the burning of lime was carried on largely over the State, but in later times, since the introduction of phosphates and the improvement of transportation facilities, the old quarries and kilns scattered so widely over the country have been for the most part abandoned. There are still several large industries in the marble belt of the Piedmont area and in the blue limestones of the Frederick and Hagerstown valleys, supplying lime for agricultural purposes, especially in the Frederick valley. Many of the largest companies now located in Maryland are deriving their supply from more favorably situated deposits outside the State.

The limestone and marble are also used as flux for blast furnaces. The coarse-grained marbles of Texas have furnished a large amount for this purpose, and also the limestone quarries at Cavetown on the Western Maryland Railroad. Hydraulic cement has been extensively manufactured from the limestone of the Cayuga formation of Silurian age at Cumberland and Hancock, as well as from the older Shenandoah limestone of the Hagerstown Valley near Sharpsburg. The products from these industries have an excellent reputation and have been largely employed both within and without the State.

Another use to which the limestones of the State has been applied in recent years has been in the manufacture of asphalt blocks for street paving. These blocks are constructed of crushed and pulverized limestone, Trinidad asphalt, and a residuum of petroleum heated separately and thoroughly mixed and then combined under heavy pressure. These blocks have been used extensively in Washington and Baltimore in recent years.

The total value of the lime and cement products of Maryland averages annually about $500,000.

The Sands.

The sand deposits of the State are widely extended both in the eastern and western sections, but have been but little developed hitherto. The sandy sediment which has been deposited upon the bottom of the Potomac River has been dredged in recent years and used extensively for building purposes in Washington.

The most important sand deposits in the eastern portion of the State are found in the Magothy and Raritan formations in Anne Arundel County, and extensive openings have been made near the head of the Severn River, where a very pure grade of glass sand is taken out. The output of these diggings is transported on small schooners which are able at high tide to reach the head of the river.

The Tuscarora and the Oriskany formations of the western portion of the State also afford very pure deposits of quartz which have been ground up and employed to some extent in glass-making. The Oriskany strata in adjacent portions of West Virginia and Pennsylvania have been extensively worked for many years and afford the chief sources of high-grade glass sands in this country.

The sandstones, both in the eastern and western portions of the State, are capable of much fuller development. The average output yearly is about $15,000.

The Marls.

The Eocene and Miocene formations of eastern and southern Maryland are rich in marl deposits, which have never been developed except for local uses. Their importance to the agricultural communities where they occur has not been up to the present time very generally recognized, although they have been worked to some extent since the early portion of the last century.

The Eocene marls are glauconitic and are like the famous green-sand marls of New Jersey, which have been so extensively employed as fertilizers throughout the eastern and southern portions of that State. The Eocene marls of Maryland are found in Kent, Anne Arundel, Prince George's, and Charles counties and increase in thickness southward. The greensand marls contain commonly a small percentage of phosphoric acid and some potash, while in some areas they are also highly calcareous. When properly used they prove of much value for certain crops. They are spread over the surface of the land, or are applied in the form of a compost with barnyard manure.

The Miocene marls are mainly shell accumulations and are never glauconitic. The proportion of shells is often very great, so that the Miocene marls are commonly known under the term of "shell marls." They occur abundantly in Queen Anne's, Talbot, Calvert, and St. Mary's counties, but have never been used so largely as the greensand marls which lie to the north of them. The average value of the marls dug each year probably does not exceed $3000.

The Iron Ores.

The iron industry in Maryland was developed early in colonial days and continued until a recent date to be one of the most important factors in the prosperity of the State. Numerous references are found in the earlier records to the iron ores, and early in the eighteenth century we find considerable activity in the manufacture of iron. The Principio Company, one of the most important commercial enterprises in the early days of Maryland, was organized in 1722 and began the erection of a furnace in Cecil County near the mouth of Principio Creek. In 1761 the Governor and Council of Maryland reported to the Commission of the Board of Trade and Plantations in England that there were eighteen furnaces and ten forges in the State which made 2500 tons of pig iron per year. During the Revolutionary War the furnaces and forges of the Principio Company supplied bar iron and cannon balls to the Continental Army. The Principio Company during the War of 1812 produced cannon balls and hardware, and guns as large as 32-pounders were made for the government. Many furnaces were built in other sections of the State during the eighteenth and early portion of the nineteenth centuries, but nearly all of them have been abandoned. Among the most important of these furnaces is the Catoctin furnace in Frederick County, which was built in 1774 and furnished guns and projectiles to the Continental Army during the Revolutionary War. In more recent years several modern furnaces have been constructed near Baltimore, of which by far the largest is that at Sparrow's Point, built by the Maryland Steel Company, which, however, only employs ore obtained from sources outside of the State.

The only furnace now manufacturing Maryland iron to any extent is the Muirkirk furnace in Prince George's County. It employs very largely the carbonate iron ores which are obtained from the Arundel formation, mainly from Anne Arundel and Prince George's counties. These great lenses of carbonate ore have been worked since early colonial days, but an ample supply still remains. Two types of ore are found in these ore lenses known as the "white ore" or carbonate ore and the "brown ore" or hydrous oxide ore.

Ores of iron are found widely distributed in Maryland from the older crystalline rocks down to the more recent deposits, but the most extensive accumulations thus far discovered are the brown hematite and pegmatite of Frederick County, the carbonate ore of Prince George's County, and the iron ores belonging to the coal measures of western Maryland. Under the present conditions of the iron industry the Maryland ores have not the value which they once had, although the excellent quality of the carbonate ores still makes it possible for them to compete with the cheaper materials of the west and south. This carbonate iron has been largely used by the U. S. Government, it being guaranteed to stand 30,000 pounds to the square inch in the pig, many tests giving 40,000 pounds.

The great Maryland iron industries depend now to a very inconsiderable extent upon local iron ores. The discovery of extensive deposits in other sections of our country, particularly in Michigan, Minnesota, and Alabama, coupled with the wonderful extension and cheapening of transportation, have resulted in the past few years in driving out the charcoal furnaces and thus leaving no place for the lean ores of Maryland.

The average value of the yearly output is about $50,000.

THE GOLD.

The crystalline rocks of the Piedmont Plateau have been found to carry gold in Maryland, Virginia, North Carolina, and Georgia. The gold occurs in quartz veins which occupy the old lines of fracture in the accompanying rocks. The gold occurs either pure in quartz, or in association with pyrite, or in the pyrite itself, and is also sometimes accompanied by lead (galena), silver, and telluride of bismuth (tetradymite).

The first gold ever found in Maryland was discovered in 1849 near Sandy Springs, Montgomery County, a specimen being exhibited to the American Philosophical Society in that year. Most of the Maryland mines are located along the southern edge of Montgomery County, near the Great Falls of the Potomac. The oldest mine in this region was opened in 1867. Some wonderfully rich specimens have been obtained from this area, but the gold is so unevenly distributed that it has not yet been worked with profit. Reports are frequent of the discovery of gold in other portions of Maryland, but these finds are generally without foundation and none have as yet been proved to be of any value. The annual output of gold from the small mines in Montgomery County probably does not exceed $2500 annually.

THE MINERAL PAINTS.

Mineral paint has been produced at several points in Maryland and in widely different geological horizons. Large quantities have been obtained in the past from the brown iron-ore deposits in Frederick County, but nothing is being done at the present time in that region. Ochre mines have also been operated in Carroll and Howard counties, and something is being done in these regions at the present time.

Important deposits of paint ore have also been obtained from the Patapsco formation in Anne Arundel and Prince George's counties. This ore occurs in a fine and highly ferruginous clay and can be worked readily. There are several industries at the present time established in this belt and the opportunities for its further development are exceedingly good.

The average value of the mineral paints produced in the State is about $15,000 annually.

The Tripoli.

Tripoli, also known in the trade as infusorial earth or silica is a diatomaceous earth composed of the shells or tests of microscopic plant forms known as diatoms. It is produced in larger quantities in Maryland than anywhere else in the United States. It is found at the base of the Calvert formation and comprises beds which in Anne Arundel, Calvert, and Charles counties attain a thickness of 30 to 40 feet. The most extensively worked localities are situated near the mouth of Lyons Creek on the Patuxent River and at Popes Creek on the Potomac.

Tripoli is used for polishing powder and likewise as an excellent non-conducting cover for steam pipes; also from its extremely porous character it is used in the manufacture of dynamite cartridges. This material was first worked on the Patuxent River in 1882. The average value of the product is about $5000 annually.

The Mineral Waters.

The mineral waters of Maryland in the past have not attracted much attention, but there are several kinds which are being placed on the market at the present time with greater or less success, and two at least which are being exported in considerable quantities. A few are represented as having medicinal properties, but the majority are sold principally for table waters, mostly in the city of Baltimore. Nearly all of the well-known waters come from the crystalline rocks of the Piedmont Plateau, only a few being reported up to the present time from the Appalachian Region and the Coastal Plain. According to the Eleventh Census Report, based upon information obtained in 1890, Maryland ranked thirteenth among the states in the number of springs reported and twenty-first in the volume of product. The amount utilized in that year is stated to have had a market value of $12,057. Since then several new springs have been placed on the market, so that the importance of Maryland as a producer of mineral waters is gradually increasing. The average value of the output is about $50,000.

Around many of the springs in the Piedmont region summer resorts have sprung up, in part as the result of the pure quality of the water and in part on account of the proximity of the localities to Baltimore and Washington. Among the more important may be mentioned the Chattolanee, Strontia, Lystra, Bentley, Takoma, and Carroll springs. Many other springs are found scattered over the Piedmont Region, but little beyond local use has been made of them up to the present time.

The springs of the Appalachian Region are not as well known, although a thermal spring of saline mineral water at Flintstone, Allegany County, has for a long time been highly regarded. There are numerous cold chalybeate springs scattered throughout western Maryland, but there has been as yet no attempt to introduce the waters or develop the properties upon which they are situated.

Very few springs of mineral water of more than local reputation are reported from the Coastal Plain. The Mardella of Wicomico County is very well known and the waters have been placed upon the market. Several other springs, which have only a local value, are reported from the eastern and southern counties, among them a sulphur spring situated at St. Michael's in Talbot County.

THE ROAD MATERIALS.

The State of Maryland is well provided with road-building materials, although their character varies widely, some being far better adapted for the purpose than others. The question of transportation is, however, so important that the stone of greatest value cannot always be employed, yet there is no section of the State where there are not some materials sufficiently close at hand to render them available.

The best road-building materials in Maryland are the basic igneous rocks, which are found well developed throughout the area of the Piedmont Plateau. Of these there are several types, viz., the gabbro, the peridotite, and pyroxenite, and the diabase. The gabbro or "nigger-head" rock, as it is locally called, is most widely distributed and occupies an extensive area throughout the eastern portion of the Piedmont belt in Cecil, Harford, Baltimore, Howard, and Montgomery counties, the largest regions being found in central Harford and southern Baltimore counties. This rock is rather tough and difficult to work, but affords a valuable and permanent road metal. The peridotite and pyroxenite are not as extensively developed, but occupy very much the same area as the gabbro. These magnesian rocks are somewhat more easily worked than the gabbro, but do not have its wearing qualities. The most valuable of all these rocks is the diabase, which is so extensively used for road-building purposes in New England and New Jersey and which occurs in several long and narrow outcrops in Baltimore and Howard counties, but is far better developed in Frederick County, where it occupies a considerable area near the northern border of the State in the vicinity of Emmitsburg. The chief cementing material in all of the igneous rocks is the hydrous oxide of iron.

The next group of road-building materials includes the marble, the limestone, and the calcareous sandstones and shales. The carbonate of lime contained in these deposits acts as a valuable cement, but the materials have far less durability than the igneous rocks above described. They are found covering widely separated areas throughout the Piedmont Plateau and Appalachian Region, the most extensive and available deposits being found in the long, narrow valleys to the north of Baltimore City and in the Frederick and Hagerstown valleys farther west. These materials have already been considerably employed for road-building purposes.

The third group of road-building materials includes the gravels of the eastern and southern portions of the State, which belong to the late Mesozoic and Cenozoic formations. They cover extensive areas in Cecil, Kent, Queen Anne's, Talbot, Anne Arundel, Calvert, Prince George's, and Charles counties, and with lessening importance extend into the more southern portions of the State. These gravels are rich in iron, which acts as the cementing material. They probably afford less permanent road metal than the igneous rocks which were first described, but when properly used are of great value in road construction.

Several of the other rocks, both in the Piedmont Plateau and the Appalachian Region, have been locally employed for road-building purposes, some of the schists and shales as well as some of the more quartzose rocks proving useful though lacking the cementing qualities of the three groups of rocks above described. The average yearly production of these materials amounts to about $175,000.

MISCELLANEOUS PRODUCTS.

There are several other mineral substances of greater or less economic importance, which are either being worked to-day to some extent in Maryland or which have been earlier worked within the State, in some instances with great success. None of these products will probably give rise in the future to industries of great magnitude, either on account of the insufficient supply of the material or on account of the very limited use of the products themselves.

COPPER.—The copper ores of Maryland are found in the eastern and western divisions of the Piedmont and in the Blue Ridge. In every instance they appear to be associated more or less directly with igneous rocks though sometimes the ore may be best developed in rocks of some other character. The copper deposits lie in a series of zones which follow the general structural lines of the region. Three of these zones, or "veins" as they were called, prior to the opening of the Lake Superior copper region about 1844, and later of the Montana and Arizona mines, were considered of no mean importance, and did actually make Maryland for a time a copper-producing State. The first of these zones extends along the Linganore Hills in Frederick County from New London northward, through Liberty to Union Bridge, the ore occurring in limestones and slates or meta-rhyolites. The second zone runs northeast from Sykesville, through Carroll County, to and beyond Finksburg, the ore being found in the slates and schists. The third deposit, in the Bare Hills of Baltimore County, occurs in an altered gneiss or schist near the contact with the serpentines.

CHROME.—The chrome industry in Maryland originated in the discovery in 1827 of chrome ore in the serpentine of the Bare Hills in Baltimore County. Subsequently to that, other deposits were found associated with the serpentine in Harford and Cecil counties, as well as at other points in Baltimore County. Between 1828 and 1850 Baltimore supplied most of the chrome ore consumed by the world, the remainder coming from the serpentine and platinum washings of the Ural Mountains. After 1850 the foreign demand for Baltimore ore declined gradually until 1860, since which time almost none has been shipped abroad. The reason for this was the discovery in 1848 of great deposits of chromite in Asia Minor. This region now supplies largely the world's demand. Since 1886 practically nothing has been done with the chrome deposits of Maryland, although Baltimore is still one of the most prominent centers for chromium salts.

Lead and Zinc.—Traces of galena and zincblende were early noted near the quarries at Jones Falls in Baltimore County, but much more decided indications of these minerals occur in connection with the crystalline limestone in the western part of Carroll and the eastern part of Frederick counties, where attempts have been made to mine them in the region to the southwest of Union Bridge. In spite, however, of the frequent traces of both these minerals throughout central Maryland, it may be confidently asserted that neither will probably be found to occur in amounts that will repay mining.

Iron Pyrites.—Small deposits of iron pyrites occur in the Magothy formation on the Magothy River, Anne Arundel County, and works were built at Cape Sable several generations ago for the manufacture of sulphuric acid but these have long since been abandoned. The discovery of much larger deposits at other points was the cause for the decline of the industry.

Manganese, Antimony, Molybdenum.—The traces of these metals which have been detected in Maryland are even more insignificant than those of lead and zinc. Manganese was once mined a short distance west of Brookville in Montgomery County, but the deposit was not sufficiently extensive to be profitable. More recently manganese has been reported from Allegany County. Specimens of the sulphide of antimony have been obtained in the Middletown Valley but nothing is known of its occurrence or extent. The earliest discovery of molybdenite mentioned on this continent was made at the Jones Falls gneiss quarries in 1811, but the deposit was not sufficient to be of economic value.

Soapstone.—Soapstone is a compact variety of talc and in composition is a hydrous silicate of magnesium. It has been worked to some extent in Carroll, Harford, and Montgomery counties, the most extensive deposits being found a short distance to the northwest of Marriottsville in Carroll County, where for a time the stone was sawed into slabs for the manufacture of bath tubs. In later years the product has been ground and sold to manufacturers of fire-proof and acid-proof paints, although some slabs are sawed out occasionally for fire-brick and hearthstones.

Asbestos.—The crystalline rocks of Maryland contain several deposits of asbestos, most of which, however, is not true asbestos, although it passes under that name, but is the fibrous variety of serpentine known as chrysotile. These deposits are in both quality and quantity of production inferior and unimportant. In 1880 one mine in Harford County and three in Baltimore County produced a total of 40 tons valued at $1000, but the discovery of extensive deposits in other regions has now entirely stopped any operations for this mineral in Maryland.

Mica.—The coarse pegmatites which abound in many parts of the eastern Piedmont region afford good-sized plates of light-colored mica (muscovite), and attempts have been made to secure commercial quantities of this in both Harford and Howard counties, but they have not been successful.

Graphite.—Traces of graphite have been found near Pylesville in Harford County at the edge of the Peachbottom slate belt. Several deposits occur farther northward in Pennsylvania where they have been mined to some extent.

AGRICULTURAL SOILS.

Introductory.

The soils of any region constitute the surface exposures of the various geological formations which occur at that place. The study of considerable areas of soils, located in many different states and derived from many different geological formations, has developed several facts concerning the relationships which exist between the soils and the geology. Without entering into details, it may be stated that the classifications employed in geological science and in soil science are not identical, although in the study of the soils the geological relationships must always be taken into consideration. In making a geological classification of the rock-forming material of any region it is important to study the geological history of the region. On this account the time element enters largely into the identification of geological formations and the construction of maps which shall represent them. Similarly, when geological maps are drawn it is not always most necessary to represent the actual occurrence of the material which lies exposed to the air. In a region where ore deposits, coal, oil, or other economic geological products occur it is frequently of prime importance to show the location of the materials with which they are associated. Thus a geological map frequently shows the underlying rock formations and gives very little space to the delineation of a few feet of sand, loam, or clay which may occur at the surface. It is with this latter class of materials that the soil map is chiefly concerned, since the surface deposits, even though no more than 2 or 3 feet in thickness, are the ones which interest the farmer and the ones upon which vegetation, either wild or cultivated, flourishes.

The classification of the soils does not consider to any great extent the geological age of the material from which the soils are derived, since it is highly immaterial to a crop of sweet potatoes whether the soil upon which it is growing is of rather recent date, as in the case of soils derived from

Pleistocene formation, or whether it is comparatively ancient, as would be the case if it were derived from Cretaceous deposits. So far as the farmer and his crop are concerned, sand is sand, and a sweet potato crop will thrive as well upon a sand of one age as upon sand of another age, provided the physical texture, chemical composition, drainage, aeration, and the other factors which affect plant growth are equal or nearly so. Thus the soil map of any region does not coincide exactly with the geological map of the same area. Still it is possible, in the great majority of cases, to state with considerable accuracy that a given geological formation which has once been studied and its soil type or types determined, will be found in other areas not yet studied to give rise to the same class of soils. There are two general rules which must be taken into consideration whenever an attempt is made to show the relationships between the soils of a region and its geological formations.

The first of these general propositions is that a single geological formation may give rise to two or more different soil types. It matters little whether the geological formation is an unconsolidated marine sediment, such as occurs in the Coastal Plain region of Maryland and elsewhere, or a solid granitic rock, such as occurs in the Piedmont section of the United States, or even a limestone such as occurs in the Hagerstown and Frederick valleys. In the Coastal Plain region the soils are laid down as marine sediments from suspension in ocean water. Because of this method of formation, there may be deposited at one and the same time, stiff, plastic clays in deep, quiet water, medium or coarse sands near the shore-line, and gravel and boulder beds where some large stream is rolling rock fragments seaward. All of these materials might well be classified as a single geological horizon, since their formation has taken place at approximately the same time, but when these materials are elevated above sea-level and become soils, the clay, the sand, and the gravel have totally different relationships to crops, and will constitute at least three different types of soil. In the Piedmont Region, where there are extensive areas of granitic rocks, the frost, the rain, burrowing animals, and the growth of plants all tend to break the solid rock into finely divided earth material which ultimately constitutes a soil. While the original rock over a considerable area may remain identical, the character of the geological forces at work in producing soils may vary considerably within small limits. This is especially true where not only weathering or soil preparation is being carried on, but also erosion, or the removal of completed soils is taking place, and the character of the soil which is formed depends to a considerable degree upon a nice adjustment of the two sets of forces embraced in the words "weathering" and "erosion." Thus the same granite rock may give rise in one place to a sandy loam soil, in another place to a loam, and in still another place to a clay. These remarks apply in the same way to soils derived from limestones, sandstones, shales, slates, and a variety of other solid rocks.

The second of these general propositions is that a soil type agriculturally uniform throughout may be derived from more than one geological horizon. A single example will serve to illustrate this point. Suppose that at any one time a bank of sand of Cretaceous age is subject to wash from the falling rain and the flowing streams and that a part of this sand is removed, transported a few miles, and laid down as a bank or bar of sand within some tidal estuary or along a shore-line. The character of the sand itself will change very little during this operation, but if the work is being carried on at the present time the sand in its old original locality will be Cretaceous in age, while in its new, derived locality it will be Recent in age. Thus there will be a wide discrepancy in geological age between the sand in the two localities, but this will be either the chief or the only difference between the two deposits. As soon as the Recent sand is elevated sufficiently above water-level to be well drained, it will become the home of plants, and is very likely to be as well suited to the production of watermelons, sweet potatoes, or some other crop, as the same sand in its old home locality. Thus the character of the material dominates the crop adaptation, while the age of the material very frequently has little effect upon its agricultural value.

Holding in mind the differences in climate due to variations in altitude and topography, the consideration of the variations in the soils themselves will show that the agricultural resources of the State of Maryland are extremely varied, and that few areas of the same size present so admirable an opportunity for the selection of climatic and soil conditions suitable for the production of a wide range of crops, for the employment of intensive methods of cultivation, and for sharp discriminations in the specialization of crop production.

The Soils of the Eastern Shore.

In southern Cecil County, in Kent, Queen Anne's, and Dorchester counties the higher lying areas are occupied by a type of soil called the *Sassafras loam* in the State Geological Survey and the United States Bureau of Soils reports. Both on the Eastern Shore, and in the majority of instances in Southern Maryland, this soil is derived almost solely from materials which are known to belong to the Wicomico formation of Pleistocene age. The surface soil of this type consists of about 10 inches of mealy brown loam which is underlain by a heavy, reddish-yellow loam subsoil to a depth of from 3 to 6 feet. This in turn rests upon gravelly and sandy sub-strata, which aid greatly in the natural underdrainage of the soil. There are to be found, also, in Wicomico, Somerset, and Worcester counties other areas of this type occupying the level terraces and river necks.

In Cecil, Kent, and Harford counties, where the Sassafras loam is in the best state of cultivation, it produces from 20 to 25 bushels of wheat per acre, from 40 to 60 bushels of corn, and about one ton of hay. It is used extensively for the production of sugar-corn for canning, and it also produces 7 or 8 tons of tomatoes per acre. This type has been long occupied by the famous peach orchards of Maryland and Delaware, while more recently the culture of pears has been engaged in profitably. This type is the best adapted of any in the entire Coastal Plain to the purposes of general farming. Its present value ranges from $65 per acre in the northern counties to $10 or $15 per acre farther south.

South of the Chester River there are large areas of orange or brown sand of medium coarseness, known as the *Norfolk sand*. This soil type illustrates the occurrence of materials which are agriculturally of the same character in two or more geological formations, the Norfolk sand of the

Eastern Shore occurring in both the Wicomico and Talbot formations of the Pleistocene age. This soil also occurs along the river necks of Cecil and Kent counties, but it is a more prevalent type farther south. The surface soil consists of a coarse to medium brown sand having little coherence. It is frequently more loamy than the sub-soil, due to a small admixture of humus. The depth of this surface soil is usually about 8 inches. The sub-soil consists of friable orange or yellow sand extending to a depth of several feet. The type maintains a moisture supply of from 5 to 10 per cent of water, and is easily warmed and well suited to the production of all early truck crops. It occupies the broad, flat river-necks and low divides of the southern portion of the Eastern Peninsula. It is a typical early truck soil, widely utilized for such purposes from Long Island to Cape Hatteras. Wherever shipping facilities are adequate, as on the Eastern Shore, or where the population understands the production and marketing of truck crops, this soil is held in high esteem. Many acres of Norfolk sand are still awaiting development in the southern counties of this region. The experience of all the better farmed localities proves the adaptation of this type to the production of sweet potatoes, watermelons, and cantaloups of fine quality, and also to early peas, sugar-corn, tomatoes, rhubarb, and root crops. In the near vicinity of large markets the Norfolk sand attains to almost fabulous values. On the Eastern Shore its value ranges from $50 down to $3 or $4 per acre. This soil offers excellent opportunities to those desiring to secure land in locations suitable for trucking and market-gradening. It is not a general-purpose soil.

The *Portsmouth sand* is another type suited to the trucking industry. It is found on both the Wicomico and Talbot formations. The surface soil is a fine-grained, black or brown loamy sand which owes its color to a high humus content. It is underlain at a depth of about 10 inches by a fine-grained gray or yellowish sandy subsoil. The Portsmouth sand occupies low-lying, poorly-drained hollows and bowl-shaped depressions in the southern part of the Eastern Shore. At present it is chiefly timbered or cultivated to general farm crops. It should be cleared, drained, and cultivated to celery, onions, cabbage, late strawberries, and similar late truck crops. In the vicinity of Portsmouth, Virginia, whence its name is derived, it is utilized as a general truck soil.

The *Elkton clay* is a poorly-drained counterpart of the Sassafras loam, occurring chiefly in the Talbot formation. It is probable that a large part of it could be converted into the better type by proper underdrainage. In its present condition, the surface soil is a brown loam having a depth of about 9 inches. The subsoil is a stiff, mottled yellow and gray clay loam. It is a fair grass and wheat land, but to attain its highest value it should be drained and used as a general farming soil. The Elkton clay occupies low river necks and poorly-drained divides throughout the region.

Other types of importance on the Eastern Shore are *Sassafras sandy loam, Sassafras gravelly loam,* and *Meadow.* The first two occur in the Wicomico formation in the northern portion, and largely in the Talbot formation in the southern portion of the Eastern Shore. Meadow represents poorly-drained land not suitable for agricultural crops at the present time. It may occur in materials of any geological age. In the northern part there are large areas of *Susquehanna clay* and *Susquehanna gravel,* both of which are nearly worthless for agricultural purposes. These soils are derived from the formations of the Potomac Group. Unfortunately, they are crossed by the main railroad system and present to the traveller a picture of desolation which is very far from representing the scenes to be enjoyed only a few miles away on either hand.

Along the Atlantic coast line the marshes are underlain by *Galveston clay,* and the barrier beaches consist of *Galveston sand,* neither type possessing any agricultural value at present. These are both of Talbot age.[1]

THE SOILS OF SOUTHERN MARYLAND.

The *Sassafras loam,* as already described along the Eastern Shore, occupies small areas along the river terraces of Southern Maryland. Here, also, it is a product of the Wicomico formation. It is usually not

[1] For more extended descriptions of these soil types, see Reports and maps of Maryland Geological Survey and U. S. Bureau of Soils.

so well tilled as on the Eastern Shore and produces smaller crop yields. The *Norfolk sand,* also previously described, occupies considerable areas on the low, flat river-necks of Southern Maryland, and it is also extensively developed, with a more hilly topography, along the streams and in the upland regions. Its prevalence in the northern part of Anne Arundel County has rendered that region pre-eminent in Maryland as a producer of truck crops, its cantaloupes and early peas receiving especially favorable notice. In the more southern counties the Norfolk sand is utilized in the production of peaches, tobacco and corn. In the Southern Maryland counties this soil is not only derived from materials occurring in all of the Pleistocene formations, but it is also found where sandy members of the older underlying formations reach the surface.

The *Sassafras sandy loam,* which is well adapted to the production of all canning crops, is quite extensively developed in the form of river terraces in Southern Maryland, and *Elkton clay* is occasionally encountered in Prince George's County. Both of these types have the same geological relationships as on the Eastern Shore.

The chief upland or plateau type in St. Mary's, Charles, and Prince George's counties is the *Leonardtown loam.* This soil type is derived from materials of Sunderland age, and also from the older Pliocene deposits found upon the highland in all the Southern Maryland counties. The surface soil to a depth of about 9 inches is a yellow or gray silt loam. It is underlain by a mottled red and gray clay loam subsoil, which is in turn underlain at a depth of from 5 to 8 feet by gravel beds or gravel and sand. A large part of this type is occupied by white oak and pitch pine (*P. rigida*) forests. When so occupied its value is about \$2 or \$3 an acre. The value of the cleared lands varies from \$5 to \$12 per acre. While this land is little esteemed by the majority of farmers of this region, its capabilities have been abundantly demonstrated upon a few farms where improved methods of tillage, fertilization, and crop rotation are practiced. In St. Mary's County, near Park Hill, certain farms on this type are producing from 20 to 25 bushels of wheat and 35 bushels of corn per acre. Near New Market one farmer is securing $1\frac{1}{2}$ tons of hay per acre. Similarly, in Prince George's County, a few farms under good cultivation show the capabilities of the type and display the opportunities awaiting farmers who will and can use stable manure and green crops as sources of humus, will apply lime, and will increase the depth of surface loam by gradually increasing the depth of plowing. This type should be farmed to general grass and grain crops, with the breeding of cattle as an adjunct to permanent soil improvement. The omission of tobacco from the rotation is imperative.

The *Norfolk loam* has a fine-grained, sandy-surface soil, underlain by a reddish-yellow, fine sandy loam subsoil. The soil and subsoil mass rests upon yellow or orange sand of medium grade. The type occupies ridges and crests along both the Patuxent River and Chesapeake Bay. This type is probably a product of the Sunderland formation. Its surface is usually slightly rolling or nearly level. The Norfolk loam produces small yields of Maryland pipe-smoking tobacco of excellent quality. It is peculiarly well adapted to the production of small fruits and the later truck crops. With better transportation facilities this type would afford an excellent soil for producing strawberries, dewberries, raspberries, and blackberries for the Washington and Baltimore markets.

The *Collington sandy loam* has a loose, loamy brown sandy surface soil, usually about a foot thick. It rests upon a sticky, yellow or greenish-yellow clayey and sandy subsoil. Both soil and subsoil are derived from the decomposition and chemical alteration of beds of greensand (glauconite), a material rich in potash. Indeed, the subsoil of the type frequently contains as high as 2½ per cent of potash salts. The type occupies considerable areas in central Prince George's and Anne Arundel counties. It produces larger yields of corn, tobacco, and grass than the average of the region. It is also well adapted to the production of peaches, pears, and plums, and to the cultivation of white potatoes and peas. It is underlain in all cases by greensand (glauconite) marls such as are used extensively in New Jersey for purposes of fertilization. The Maryland marls are not as rich in phosphoric acid and lime as those of New Jersey. The Collington sandy loam is notable among the agricultural soils of Southern Maryland on account of its being a single type derived chiefly from a single geological formation. It has been formed by

FIG. 1.—VALLEY FARM-LANDS OF THE PIEDMONT PLATEAU, WITH MONOCACY AQUEDUCT, FREDERICK COUNTY.

FIG. 2.—LEVEL FARM-LANDS OF THE COASTAL PLAIN, TALBOT COUNTY.

VIEWS OF MARYLAND FARMING LANDS.

the weathering out of the greensands of Eocene age where they are exposed at the surface.

Large areas in northern Prince George's and Anne Arundel counties are occupied by *Susquehanna clay* and *Susquehanna gravel,* two soils which are nearly worthless for agricultural purposes. The *Susquehanna clay loam* consists of a surface covering of sand or sandy loam over a Susquehanna clay subsoil. It is fairly productive for general farm crops. The *Windsor sand* is a coarse, sandy, and somewhat gravelly soil found in southern Prince George's and in Calvert counties. It bears some excellent peach orchards, but is usually of little value for agricultural purposes and is occupied by pitch-pine forests and thickets. Of these soils, the Susquehanna types are derived from the various deposit of Potomac age, as on the Eastern Shore. The Windsor sand may be derived from several formations, but the larger portion of the material from which it is derived falls within the Sunderland formation of the Pleistocene.

THE SOILS OF NORTHERN CENTRAL MARYLAND.

The *Cecil loam,* derived from the decay of granite and other similar rocks, constitutes the principal soil type of this entire region. It occupies large areas in the western part of Cecil County, in Harford, Baltimore, Howard, and Montgomery counties, and a smaller area in Carroll County. The surface soil is a loam or heavy sandy loam of a brown or yellow color, having a depth of about 10 inches. It is underlain by a heavy loam or silt loam of a reddish-yellow color. Both soil and subsoil frequently contain fragments of quartz and of the partially decomposed parent rock. The Cecil loam is very generally recognized as well adapted to general farming under careful management. It produces about 15 bushels of wheat per acre, from 30 to 50 bushels of corn, good yields of grass, and 7 or 8 tons of tomatoes. In Harford County a large amount of sugar corn for canning purposes is produced on the Cecil loam, and the corn fodder is fed to extensive dairies which supply milk, cream, and butter to Baltimore. The type is well watered and is valued at from $35 to $80 per acre as farm land. Much higher prices are paid for locations suited for suburban or country residences.

The *Cecil mica loam* closely resembles the Cecil loam, except that both soil and subsoil contain large percentages of flakes of white (Muscovite) mica. It is formed from the decomposition of the highly crystalline Wissahickon schists and constitutes a fair general farming soil somewhat less productive and durable than the Cecil loam. It is locally known as the "gray lands."

The *Cecil clay* occupies broad belts and scattered, irregularly shaped areas which extend from northern Cecil County across Harford and Baltimore counties into Howard County. The surface soil, which has a depth of about 6 inches, is a dark red or reddish-brown clay. It is underlain by a stiff, tenacious red clay subsoil which grades into the undecomposed gabbro from which the soil is chiefly derived. Locally some areas are heavily strewn with boulders which have resisted the processes of decomposition. These are usually forested. The type is spoken of as the "red lands" from its color. It constitutes a strong, durable general-purpose soil, producing good crops of corn, wheat, and grass, and fair yields of tomatoes. Its surface is rolling to hilly and numerous streams have their headwaters within its areas.

Throughout the northern central region, especially in Baltimore and Carroll counties, are found small limestone valleys marked by fertile loam and clay loam soils. These resemble the limestone valleys further west in Maryland, in their crop adaptations and yields. There are also considerable areas of loamy soils in western Montgomery, Howard, and Carroll counties derived from the slaty rocks of the region. Though none of these types has been mapped, they are known to be fairly fertile general-purpose soils.

The Soils of Frederick Valley.

The Frederick Valley, at the eastern base of the Catoctin range, has two main series of soil types. The shales and sandstones of the Triassic (Newark) series give rise to the *Penn* series of soils, investigated and mapped in the Trenton, New Jersey, and the Lebanon-Dauphin, Pennsylvania, areas. The Newark brownstone gives rise to a red sandy loam soil and subsoil, known as the *Penn sandy loam.* Sandstone fragments are common in both soil and subsoil. The subsoil approaches a clay loam in many cases. The type is easily tilled, but the crop yields are rather small. The *Penn loam* consists of a dark red loam surface soil underlain by a heavier red clay loam subsoil. The surface is gently rolling and fairly well drained. The soil is esteemed as almost equal in fertility to the much better known limestone soils of the region. The *Penn clay* is very similar, except that both soil and subsoil are a stiffer clay. Wheat, corn, and grass are the principal crops.

The limestone soils which cover the southern part of the Frederick Valley are the *Hagerstown loam* and *Hagerstown clay.* Their full description is given in the account of the Hagerstown Valley.

THE SOILS OF CATOCTIN MOUNTAIN AND BLUE RIDGE.

The region comprised in the Catoctin and Blue Ridge mountains and the included Middletown Valley has not been mapped with respect to its soils, but it is known to contain among others the *Porters series* of soils mapped in similar areas in Virginia and North Carolina. The famous mountain peaches of Maryland are produced on the *Porters black loam* of the mountain coves and valleys of the region. The soil is a brown sandy and stony loam having a rich dark-brown or black color, due to large amounts of organic matter. The soil is fertile, but is difficult of cultivation for ordinary crops on account of its stony character and steep slopes. It is only partially utilized for peach orchards, and the industry may be more extensively developed. The Newton (Albemarle) pippin can also be raised with profit in this region and in the Middletown Valley. The Valley lands are formed of loams and clays derived from the weathering of volcanic rocks. They are well adapted to wheat, corn, oats, and grass, and constitute good soils for apple culture.

THE SOILS OF HAGERSTOWN VALLEY.

The Hagerstown Valley and the southern portion of the Frederick Valley are occupied by a very characteristic series of soils derived from the weathering of the Shenandoah limestones. The *Hagerstown loam* has a surface soil which consists of a brown or yellow loam about 12 inches deep.

It grades downward into a yellow clay loam which extends to a depth of 2 feet or more, which in turn is underlain by a stiff, tenacious red clay. The surface of the type is rolling to gently undulating, and the area is well watered by numerous streams. Of these Antietam Creek drains the Hagerstown Valley and the Monocacy River is the chief stream in the Frederick Valley. The Hagerstown loam is one of the strongest, most durable, and most fertile soils occurring east of the Alleghany Mountains. It frequently produces 30 bushels of wheat, 60 bushels of corn, and 2 tons of hay per acre. It is also adapted to apple orcharding and serves as a basis for extensive dairy operations. The land is high-priced but not expensive. The majority of farms on this type are improved with good houses and barns and little land in the area can be purchased for less than $60 per acre.

The *Hagerstown clay* differs from the Hagerstown loam chiefly in lacking the more loamy surface soil. The subsoil material of the loam is closely the equivalent of the surface of the clay. The Hagerstown clay is a little more difficult to work than the loam type, but it constitutes a strong and fertile wheat and grass soil. Small ridges and knolls occur throughout both of these types. They are occupied by a sandy loam soil of the same Hagerstown series. Such areas produce fair grass and grain crops and also bear good apple orchards. All of these types have originated from the decay and solution of limestone rock. The soils are not especially rich in lime, as this material has largely been dissolved during the processes by which the soil was formed. The physical texture of these types is improved and good tilth secured by generous applications of lime. This causes a granulation of the soil and aids all the processes which constantly prepare plant food from the soil mass.[1]

THE SOILS OF THE APPALACHIANS.

The soils of the more mountainous region of the Appalachians in Western Maryland follow in their variations the geological formations

[1] For complete description and maps of these regions, see U. S. Bureau of Soils. The types of the Hagerstown Valley are described in the reports on Lancaster County, 1900, and Lebanon County, 1901, of the Pennsylvania areas lying in the northward extension of the same valley.

from which they are derived. In the majority of cases the types occur in long, narrow areas along the crests and flanks of the mountains. They consist of clay, loam, and sandy loam soils which are occupied extensively by hardwood forests or are cultivated in small areas to grass, oats, rye, and buckwheat. The most important type of the region is derived from the surface decomposition of the Helderberg limestone. The surface soil here is usually a heavy red or yellow loam and the subsoil a clay loam of the same color. This soil is adapted to the production of corn and wheat, and it also constitutes a naturally blue-grass soil. Where the soil is stony from the presence of undecayed limestone and chert, rye and potatoes are raised, and on favoring slopes peaches, grapes, and small fruits are successfully cultivated.

The Romney-Jennings formation gives rise to yellow and gray shale loams upon which rye and oats do fairly well and early corn is a profitable crop. It also constitutes the mountain pasture land of the region. The Hampshire soils will be described in discussing Garrett County.[1]

The Alleghany Plateau, which constitutes the larger part of Garrett County, Maryland, is marked by comparatively few soil types. The Romney-Jennings soils were described in the previous section. Agriculturally the soils derived from the Hampshire formation are the most important. They occupy large areas in the central portion of the county. The surface is rolling to hilly and occupies altitudes of 1500 to 3000 feet or more above sea-level. The surface soils are red or reddish-brown loams and sandy loams, varying with the sandy or shaly nature of the rocks of which they form the decomposition products. The soil depth is usually 7 or 8 inches. The subsoils are heavier red loams and red clays, varying in texture with rock variations, as in the case of the surface soils. The soils are not generally strong, but are easily cultivated on all except the steepest slopes. These are forested or form pasture lands.

The Hampshire loam and sandy loam produce from 20 to 35 bushels of wheat in a favorable year, and about 50 bushels of oats per acre.

[1] See Md. Geol. Survey, Report on Allegany County.

Potatoes, rye, and buckwheat are also raised and excellent crops of hay are secured. Large areas of these types are found in the vicinity of Oakland, Accident, and Cove.

The only other soils of considerable extent are those derived from the Allegheny formation. The soils are shallow, and sandy loams predominate. Oats, buckwheat, and grass are the principal crops, and a large part of the formation is forested. On the Conemaugh formation, especially near Grantsville, there are considerable areas of loams and sandy loams which produce good yields of potatoes and fair yields of hay, oats, and buckwheat. Certain mountain swamp soils known as the "Glades" are very productive when artificially drained. The surface soil is a black, mucky mass which is usually underlain at a depth of about a foot by a saturated yellow clay loam. Near the larger towns this soil is used for market-gardening, and cabbage, celery, and onions could also be raised to advantage.[1]

Conclusions.

Stretching as it does from tide-water to mountain crest and including the full range of geological formations, from the most ancient to the most recent, the State of Maryland presents an exceptional diversity of climate and of soils. Its agricultural possibilities have not been developed to their full capacity. Consequently the State presents favorable opportunities to the well-trained, hard-working farmer of either small or large capital. He may locate in a selected region and devote his energies to the production of certain special crops with which he is especially familiar, or he may locate elsewhere and follow general farming, stock-raising, or dairying. If the raising of fruit constitutes his specialty, the northern and western regions present advantages for apple culture or for peach raising. Some of the best opportunities existing at present in the United States for specialized intensive agriculture are to be found in Maryland within easy reach of the great markets of Baltimore and Washington. For the home-seeker no more pleasant

[1] See Md. Geol. Survey, Report on Garrett County.

surroundings can be found than on the old plantations of the tide-water region, where the products of the water are almost as accessible as those of the land; or in the rolling plateau region of northern central Maryland, where well-tilled fields and hoarded groves of timber checker the landscape and the topography is relieved by low, rounded hills and shallow valleys. The limestone valleys can only be equalled in fertility by other limestone valleys or by the broad prairies of the Corn Belt. The western mountain and plateau region is in some part still awaiting development, although its pioneers have demonstrated its agricultural capabilities.

CLIMATE.

The climate of Maryland is controlled not only by the general meteorological conditions that affect the whole eastern seaboard but by the physical features of the State itself, the Chesapeake Bay and its tributaries in the east, and the Appalachian mountains in the west, producing a marked influence upon the distribution of temperature and rainfall in the several counties.

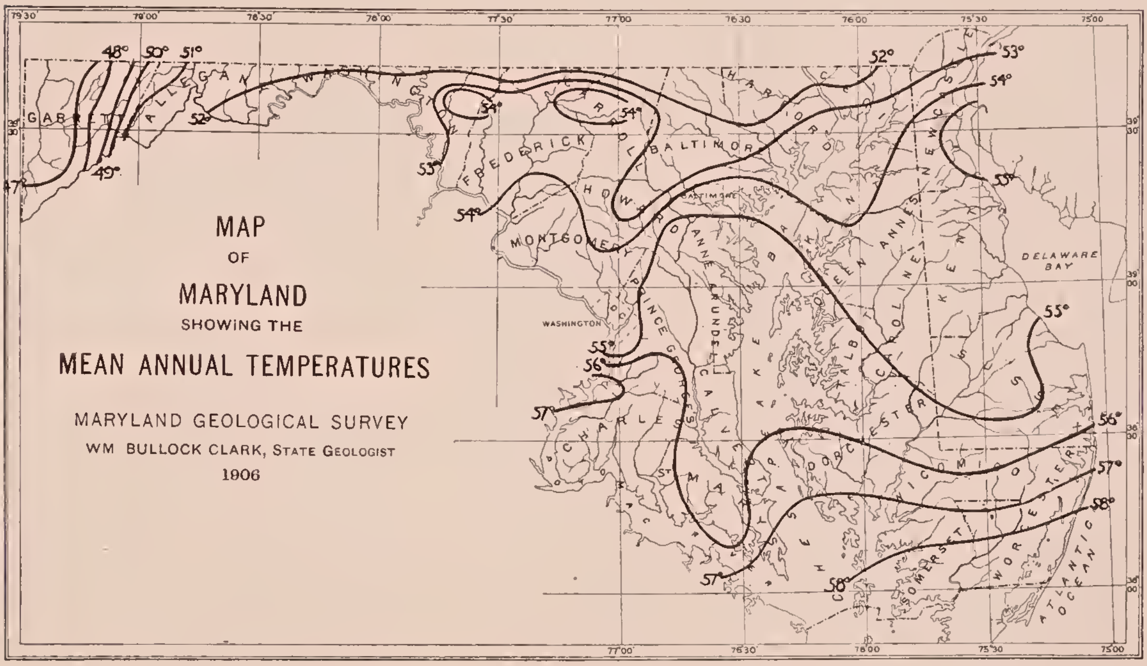

FIG. 10.—Map of Maryland showing the mean annual temperatures.

TEMPERATURE.

The normal annual temperature for Maryland is between 53° and 54°. The principal modifying influences that determine the departures from this normal, in the various climatic divisions of the State, are latitude, water areas, and elevation. The highest normal annual temperatures are found over the extreme southern counties of the Eastern and Western shores. The influence of the Bay causes an appreciable, but not very decided, increase in annual temperatures along either side as compared with the level land areas closely adjoining. Over these latter areas the temperatures are very much the same, and differ but slightly from the normal for the entire State. The lowest normal annual temperatures

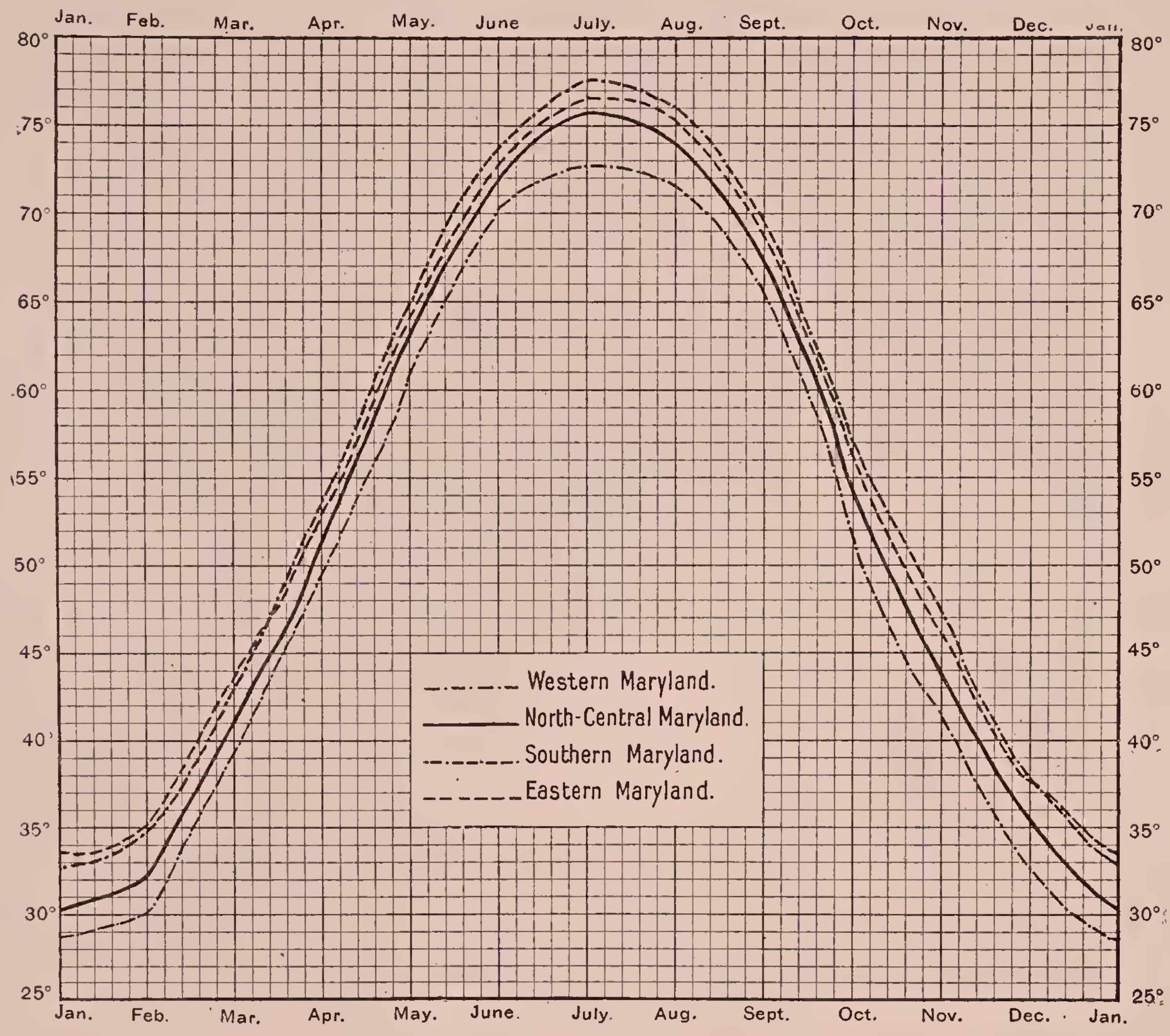

FIG. 11.—Mean temperatures in the four climatic divisions of Maryland.

occur in the western part of Garrett County, where they range from 46° at stations on the higher mountain ridges, to 48° in the plateau region lying to the north. Eastward from these higher elevations the increase in temperature is very rapid with the descent towards sea-level; a normal annual of 52° is reached in the western part of Allegany County, and an approach very nearly to the State normal is found in some of the valley depressions. Annual temperatures of 52° or below prevail over the northern portions of the Piedmont Plateau, and thence increase gradually towards the normal conditions found southward over the interior. In the extreme southern and eastern sections of the State the annual temperature rises to about 59°.

There is considerable variability in the normal annual temperature, the normal annual maximum temperature for the State being about 63°, while the normal annual minimum temperature is 45°, a difference of 9° on either side of the normal annual temperature of 54°.

The diagram on the preceding page shows the mean temperatures in the four climatic divisions of the State for each month of the year.

KILLING FROSTS.

A factor of the highest importance, especially to the agricultural and trucking interests of a community, is the average date of occurrence of the first "killing" or "black" frost in autumn, and the last in spring, and their variations in time of occurrence from year to year. Frosts are usually designated as "light," "heavy," or "killing." The term "light" is applied to frosts which are destructive only to tender plants; "heavy" to copious deposits of frost, but which do not destroy the staple products; "killing" to such as are blighting to the staple products of the locality in which the frost occurs. First and last killing frosts are tabulated below for each year from 1871 to 1904 for the vicinity of Baltimore. The data given for Baltimore represent fairly well the mean values for the entire State. In the absence of a killing frost before a minimum temperature of 32° was observed, the date of the first record of a freezing temperature was entered in the table. The interval in days between the last frost in spring and the first in autumn is likewise given in order to show the length of the period of safe plant growth.

The average date of occurrence of the last killing frost in spring, based on observations of 34 years, is according to the above table, April 4. It has occurred as early as February 26, namely in 1903, and as late as May 3, as in 1882. The first killing frost in autumn has oc-

KILLING FROSTS IN THE VICINITY OF BALTIMORE.

	Last in Spring.	Min.	First in Autumn.	Min.	Interval in days.
1871	*Feb. 23	30°	*Nov. 28	31°	....
1872	*Mar. 25	32	* " 16	30	....
1873	" 31	29	Oct 29	31	212
1874	Apr. 13	29	Nov. 10	31	211
1875	" 22	32	" 3	32	195
1876	" 2	30	Oct. 15	33	196
1877	" 3	32	Nov. 4	37	215
1878	Mar. 26	21	Dec. 6	32	255
1879	Apr. 5	32	Oct. 26	30	204
1880	" 12	30	Nov. 8	35	210
1881	" 21	39	" 27	34	220
1882	May 3	38	" 19	30	200
1883	Apr. 25	34	" 13	32	202
1884	Mar. 30	31	" 7	30	222
1885	" 16	31	" 1	36	230
1886	" 24	29	Oct. 17	36	207
1887	Apr. 6	30	" 31	32	208
1888	Mar. 19	30	" 22	36	217
1889	* " 30	28	Nov. 6	35	....
1890	*Apr. 2	31	Oct. 31	36	....
1891	" 9	36	" 29	33	203
1892	" 15	34	" 6	36	174
1893	" 16	36	" 17	36	184
1894	" 11	32	Nov. 12	27	215
1895	" 11	34	Oct. 29	34	201
1896	" 8	32	Nov. 14	32	220
1897	*Mar. 29	34	Oct. 31	39	....
1898	Apr. 6	26	" 28	34	205
1899	Mar. 25	30	Nov. 4	36	224
1900	" 22	26	" 16	28	239
1901	* " 17	30	" 11	31	....
1902	" 7	31	Oct. 30	34	237
1903	Feb. 26	29	Nov. 7	28	254
1904	Apr. 17	31	.... ..	..	....
Average date 1871-1903	Apr. 4	....	Nov. 3	....	213 Average period.
Earliest date	Feb. 26, 1903		Oct. 6, 1892		255 Longest period.
Latest date	May 3, 1882		Dec. 6, 1878		174 Shortest period.

* No frost recorded; first day in Autumn and last day in Spring with a minimum temperature of 32° or below.

curred, on the average, on November 3. The earliest appearance is that of October 6, 1892, and the latest that of December 6, 1878. In the ordinary course of events, accordingly, the period of safe plant growth in the central part of the State, based upon the occurrence of killing frosts, is from April 4 to November 3, or approximately seven months. While this is the most probable length of the period, the interval may be considerably extended by a late autumn frost in conjunction with an early spring frost, or the period may be shortened by a late spring frost followed by an early autumn frost. The extent to which this important interval has varied in the past 34 years is shown in the above table. The shortest interval, namely 5 months and 24 days, was that of 1892, extending from April 15 to October 6; the longest was that of 1878, extending from March 26 to December 6, or 8 months and 15 days. Calculating on the basis of a 34-year record, we find that the last killing frost in spring is likely to occur sometime within the first decade of April once in 4 years; in the second decade once in 5 years; in the third decade once in 11 years; the latest occurrence, as stated above, was May 3, 1882. In the autumn the first killing frost has occurred but once in 33 years in the first decade of October, three times in the second decade, and ten times in the third decade. It fell within the first decade of November 9 times, within the second decade 7 times, and within the third decade twice. The latest in 33 years occurred on December 6, 1878.

ADVENT OF SPRING.

Botanists state that the protoplasmic contents of the vegetable cells find the limits of their activity at about 43°. When the temperature falls below this point the protoplasm becomes inactive; when the temperature rises and reaches this point the protoplasm awakens, and as it passes above 43° the cell begins to grow and multiply. The advent of spring may properly be considered as taking place at the advent of an isotherm one degree higher, or 44°.

The average date has been obtained on which a daily mean temperature of 44° becomes permanent, and the result is shown in Figure 12, on page 366, which is intended to represent the average date of the advent of spring in Maryland.

It will be seen that spring first appears in the extreme southeastern counties, usually about the 7th of March. It advances northward in the next two weeks to an east and west line touching southern Delaware. Within the next four days the line moves northward, east and west, through Prince George's County. Five days later it reaches northern central Maryland, and by the first of April includes most of the State except Garrett County, which does not experience permanent spring conditions until about the middle of April.

HIGHEST RECORDED TEMPERATURES.

MAINLY FROM RECORDS FOR FIVE YEARS OR OVER.

STATIONS.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual.
Annapolis	61	63	68	87	94	95	97	94	98	85	69	64	98
Baltimore	73	78	82	94	96	98	104	98	101	90	78	73	104
Charlotte Hall	66	70	83	97	95	100	102	99	100	88	78	70	102
Chestertown	63	61	79	87	92	94	97	93	90	83	75	65	97
College Park.......	62	68	82	92	94	100	105	98	101	88	78	69	105
Cumberland........	70	66	84	94	93	101	103	101	97	87	86	68	103
Darlington	65	62	78	94	94	96	98	97	94	85	74	69	98
Deer Park..........	61	61	75	84	93	99	94	91	90	80	70	65	99
Denton	62	70	82	97	98	101	102	97	98	82	80	72	102
Easton..............	65	64	82	93	93	96	101	98	96	87	77	66	101
Frederick	64	63	75	92	95	99	104	99	96	86	75	66	104
Hagerstown........	62	62	82	92	98	98	98	100	95	88	77	66	100
Jewell	64	66	80	94	95	99	99	97	95	83	78	68	99
Laurel	64	61	80	94	94	99	104	98	100	90	77	67	104
Mardela Springs...	70	67	80	92	93	96	98	100	95	88	77	67	100
Mt. St. Mary's......	61	62	78	93	90	95	102	96	95	88	74	65	102
Newark, Del.	56	61	73	92	92	96	98	98	97	86	75	63	98
New Market........	62	61	79	93	93	99	105	98	96	85	83	65	105
Pocomoke City	69	70	81	93	96	99	101	100	96	91	81	74	101
Princess Anne	68	66	76	93	93	96	95	98	96	84	78	68	98
Seaford, Del........	65	66	82	95	94	98	100	97	95	84	75	68	100
Solomon's	66	67	82	88	100	99	99	98	98	89	77	65	100
Sunnyside	61	64	75	87	90	92	93	90	91	82	73	65	92
Van Bibber	63	62	72	91	96	95	98	96	95	87	71	68	98
Westernport	65	66	81	92	96	102	107	99	98	88	78	65	107
Westminster	60	62	82	94	99	99	103	102	98	90	74	66	103
Washington	76	78	83	93	96	102	103	101	104	92	80	73	104
Extremes for each month	76	78	84	97	100	102	107	102	104	92	86	74	107

LOWEST RECORDED TEMPERATURES.

MAINLY FROM RECORDS FOR FIVE YEARS OR OVER.

STATIONS.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Annapolis	5	−6	...	24	40	..	58	52	40	33	25	....	−6
Baltimore	−6	−7	5	24	34	47	55	51	39	30	15	−3	−7
Charlotte Hall	−1	...	0	25	37	41	49	52	40	23	18	5	−1
Chestertown	5	−9	16	25	37	43	54	51	41	30	22	9	−9
College Park	−2	−16	10	24	35	38	48	44	34	26	16	4	−16
Cumberland	−7	−12	6	25	33	45	52	50	35	22	14	2	−12
Darlington	−8	−12	8	20	38	42	51	50	40	26	18	3	−12
Deer Park	−23	−25	−13	6	20	30	32	31	22	4	−6	−20	−25
Denton	−17	−14	15	25	37	43	50	50	43	27	21	9	−17
Easton	−1	−15	15	26	38	40	52	50	38	28	21	12	−15
Frederick	−7	−10	0	25	33	39	50	45	37	25	19	0	−10
Hagerstown	−8	−14	1	20	34	42	49	48	38	26	24	1	−14
Jewell	1	−14	11	23	38	45	53	50	41	28	21	8	−14
Laurel	−4	−18	7	23	34	45	49	46	35	21	22	6	−18
Mardela Springs	−10	....	15	24	37	42	51	50	39	26	18	11	−10
Mt. St. Mary's	−14	−15	11	21	37	42	51	50	40	22	13	6	−15
New Market	−4	−14	5	21	33	45	52	49	38	25	16	3	−14
Pocomoke City	8	−4	18	27	40	46	55	55	42	33	21	11	−4
Princess Anne	1	−10	16	22	31	40	51	46	33	23	21	9	−10
Solomon's	4	−5	18	28	41	49	57	59	46	35	23	11	−5
Sunnyside	−24	−26	−2	8	24	29	33	36	24	10	−4	−17	−26
Van Bibber	−1	−11	9	23	38	43	53	50	41	31	19	10	−11
Washington	−14	−15	4	22	34	43	52	49	38	26	12	−13	−15
Westernport	−8	−13	−3	19	30	36	41	42	28	16	15	−6	−13
Westminster	−7	−16	12	22	34	..	..	..	..	30	19	7	−16
Lowest	−24	−26	−13	6	20	29	32	31	22	4	−6	−20	−26

PRECIPITATION.

The normal amount of precipitation for the entire State of Maryland, whether falling as rain, hail, sleet, or snow, is about 43 inches.

The greatest normal annual amounts occur over the western part of the Alleghany Plateau, where conditions favor both *frequency* and *intensity* of rainfall and snowfall. At Sunnyside, in Garrett County, the average annual precipitation for the past six years was 53.5 inches, or over ten inches greater than the normal annual fall for the State. This station has an elevation of 2500 feet above sea-level, and is situated on the western slope of the Backbone Mountain—a ridge running southwest and northeast, with elevation of 3000 feet.

Just east of the Alleghany Plateau the annual rainfall decreases rapidly over an area including eastern Allegany County and the greater part of Washington County, or, more strictly, the Greater Appalachian Valley. A second area of diminished precipitation is found over upper St. Mary's County and the southern part of Charles County, and a third over narrow portions of Maryland and southern Delaware, bordering on the Atlantic. These three have a normal annual rainfall of 31 to 35 inches, and are the driest regions of the two states.

The normal annual precipitation increases east of the Blue Ridge, over the Piedmont Plateau. Parr's Ridge divides the plateau into two rain-

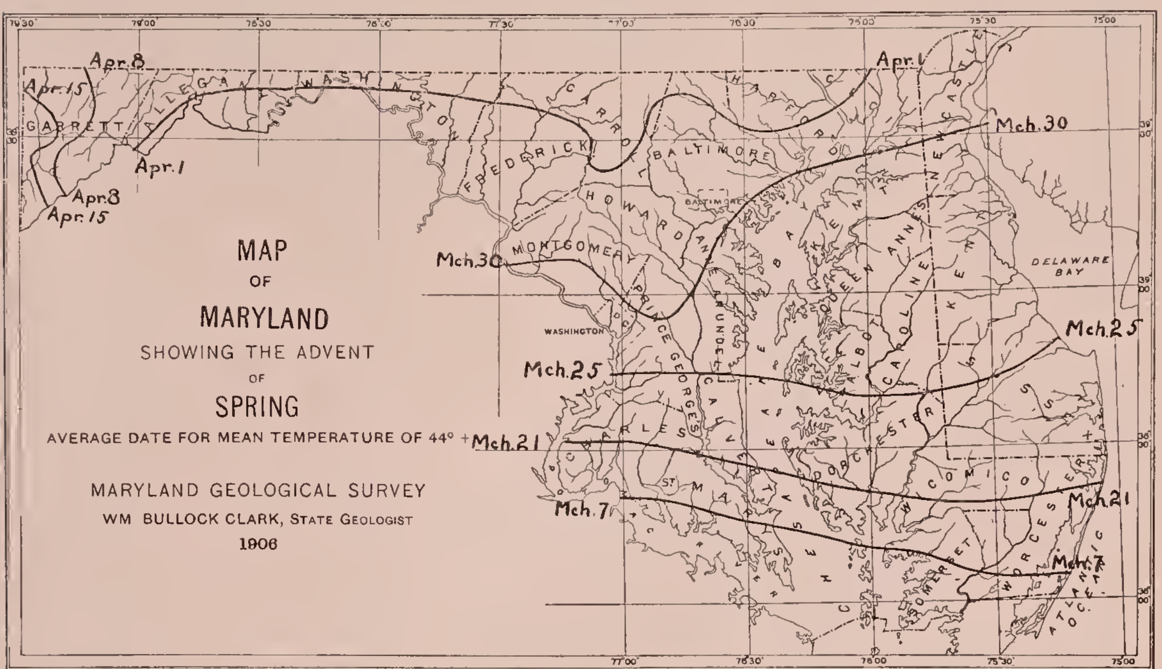

Fig. 12.—Map of Maryland showing the Advent of Spring.

fall divisions; west of the ridge the annual amounts are about 40 inches, while east of the ridge there is a general increase to 45 inches.

A narrow area over which the normal annual fall is less than 40 inches lies just west of the Atlantic coast area already mentioned as one of the dry divisions, and a second limited area of this kind is found to embrace portions of Caroline, Talbot, Prince George's, Howard, and Baltimore counties. With these exceptions, and that already noticed in portions of Charles and northern St. Mary's counties, the normal annual precipitation for the Coastal Plain is from 42 to 48 inches. The bands of greatest precipitation in this latter area include southern Anne Arundel County, and from southern St. Mary's County northeastward over portions of Dorchester and Wicomico counties.

The normal annual precipitation is divided throughout the seasons as follows: spring and summer will have 11.5 to 12 inches, and fall and winter 9.5 to 10 inches.

The normal monthly, seasonal, and annual precipitation for the several districts of the State is shown in the tables on pages 368 and 370.

Snowfall never fails completely in Maryland even in the warmest

FIG. 13.—Map of Maryland showing the Annual Precipitation in inches.

winters, although it may be reduced to insignificant proportions except in the mountains. The average monthly amounts for the various climatic divisions of the State are shown in the table below:

AVERAGE DEPTH OF SNOW IN INCHES.

	Jan.	Feb.	Mar.	Apr.	May.	Nov.	Dec.
Western section	12.0	8.9	9.2	3.1	1.8	3.2	5.2
N. Central section	5.1	5.1	6.6	2.0	....	5.6	2.4
Southern section	5.4	4.0	1.0	1.4	....	2.5	2.3
Eastern section	4.6	4.1	....	1.5	....	2.5	1.9
Entire state	6.6	5.7	5.0	1.4	0.4	3.7	2.6

NORMAL PRECIPITATION FOR THE SEVERAL DISTRICTS.

STATIONS.	No. Years Record.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.	Spring.	Summer.	Autumn.	Winter.
Annapolis	18–22	3.2	3.6	4.3	3.9	4.7	4.0	4.8	4.6	3.7	3.8	4.3	3.4	48.2	12.9	13.3	11.9	10.2
Baltimore	47–51	3.0	3.5	4.0	3.3	4.0	3.7	4.7	4.1	3.6	3.1	3.3	3.2	43.3	11.3	12.4	10.0	9.6
Charlotte Hall	4–6	2.8	3.2	3.1	3.5	3.9	2.5	4.0	2.5	1.3	3.7	2.1	2.0	34.4	10.5	9.0	7.1	8.0
Cherryfields	5–6	1.9	3.5	3.3	3.0	4.3	2.7	6.0	3.4	2.2	3.8	3.2	2.5	39.9	10.6	12.1	9.3	7.9
Chestertown	6–13	2.9	2.6	3.3	4.0	4.7	3.9	3.5	5.4	3.4	3.0	3.3	2.7	42.6	12.0	12.7	9.7	8.2
Cumberland	26–28	2.3	2.7	3.0	2.3	3.5	3.6	3.4	3.1	2.7	2.5	2.4	2.2	33.7	8.8	10.0	7.5	7.2
Easton	7–8	2.7	3.7	3.3	3.1	4.2	2.7	4.2	3.3	2.2	3.0	2.9	2.6	37.8	10.6	10.2	8.1	9.0
Emmitsburg (Mt. St. Mary's)	20–29	3.1	3.2	4.1	3.1	4.7	3.9	3.5	3.5	3.6	3.8	3.9	3.0	43.2	11.8	10.9	11.3	9.3
Fallston	26–29	3.7	4.1	4.3	3.4	4.3	4.0	4.5	4.9	4.3	3.6	3.8	3.4	48.3	12.0	13.4	11.7	11,2
Frederick	20–24	3.2	3.0	3.0	3.5	3.9	4.2	3.7	2.8	3.4	2.5	2.9	2.9	38.9	10.4	10.6	8.9	9.0
Green Spring Furnace	5–6	2.4	2.9	2.6	2.1	3.7	2.8	3.8	4.3	2.8	2.9	2.9	2.3	35.4	8.4	10.9	8.6	7.5
Jewell	8–10	2.8	3.6	4.8	4.0	5.1	3.7	7.0	3.4	3.7	3.7	3.3	2.9	47.9	13.9	14.1	10.7	9.3
Mardela Springs	10–11	2.9	4.0	4.4	4.3	4.2	2.1	6.6	3.6	3.4	4.6	3.3	2.3	45.7	12.9	12.3	11.4	9.2
New Market	9–13	2.6	3.3	3.7	3.4	3.8	3.4	4.1	4.3	3.8	2.8	4.5	2.5	42.2	11.0	12.0	11.1	8.4
Sandy Spring	7–8	3.5	3.4	4.1	2.7	3.1	5.0	5.1	4.9	3.3	3.7	3.1	3.4	45.2	10.0	15.0	10.1	10.3
Solomon's	7	2.6	4.0	3.2	3.5	3.9	3.3	4.2	3.2	2.0	3.2	3.0	2.6	38.6	10.6	10.7	8.1	9.2
Sunnyside	5–6	4.3	5.0	5.0	4.7	5.2	4.7	6.2	3.6	3.1	3.4	4.3	4.0	53.3	14.8	14.5	10.7	13.3
Washington	25	3.5	3.4	4.2	3.3	3.9	4.0	4.6	4.0	3.7	3.1	2.8	3.0	43.5	11.4	12.6	9.6	9.9

FREQUENCY OF PRECIPITATION.

The amount and frequency of precipitation have been carefully tabulated for the vicinity of Baltimore and as Baltimore is centrally located the results may be accepted as fairly well representing the average conditions throughout the State.

Considering only days with an appreciable amount of rainfall or snowfall (one-hundredth of an inch or more) there are on the average 131 per year. The limits of variability in 33 years were 164 and 104. Such

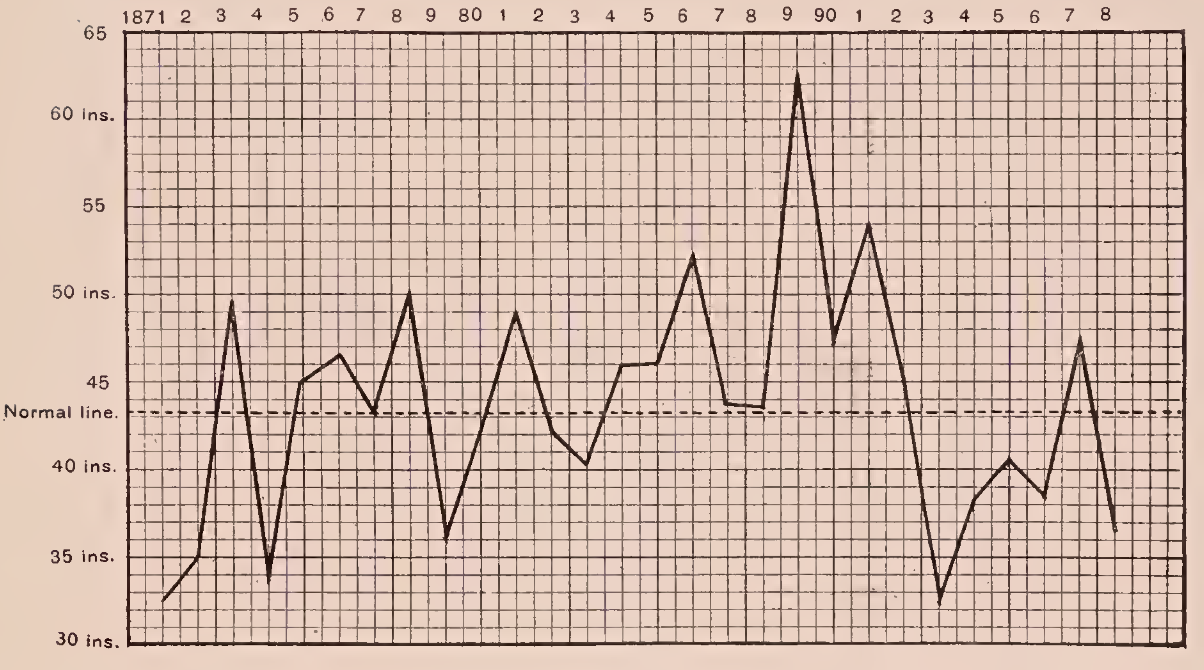

FIG. 14.—Fluctuations in Annual Precipitation at Baltimore, 1871-1898.

days are least frequent in September and October and most frequent in March. With normal conditions, the rainfall is ample at all periods of the year. Disastrous droughts are of rare occurrence. The variations in the total annual frequency of rainy days from year to year are confined within quite narrow limits. The successive ten-year averages from 1871 to 1900 were 130, 142, 127, respectively.

In addition to the days with an appreciable quantity of rainfall or snowfall, there are nearly 40 per year on the average, during which light sprinkling rains, or mists, are recorded. Their distribution throughout the year closely follows that of the days with appreciable quantities of precipitation. While the individual effect of these light rains is small their aggregate annual value to vegetation cannot be neglected.

The most frequent quantity of rain or snow, and hence the most probable quantity to be expected upon any day, is some amount between one-hundredth of an inch and one-tenth of an inch. The average monthly and annual frequency of stated amounts, based upon a record of 32 years at Baltimore is shown in the following table:

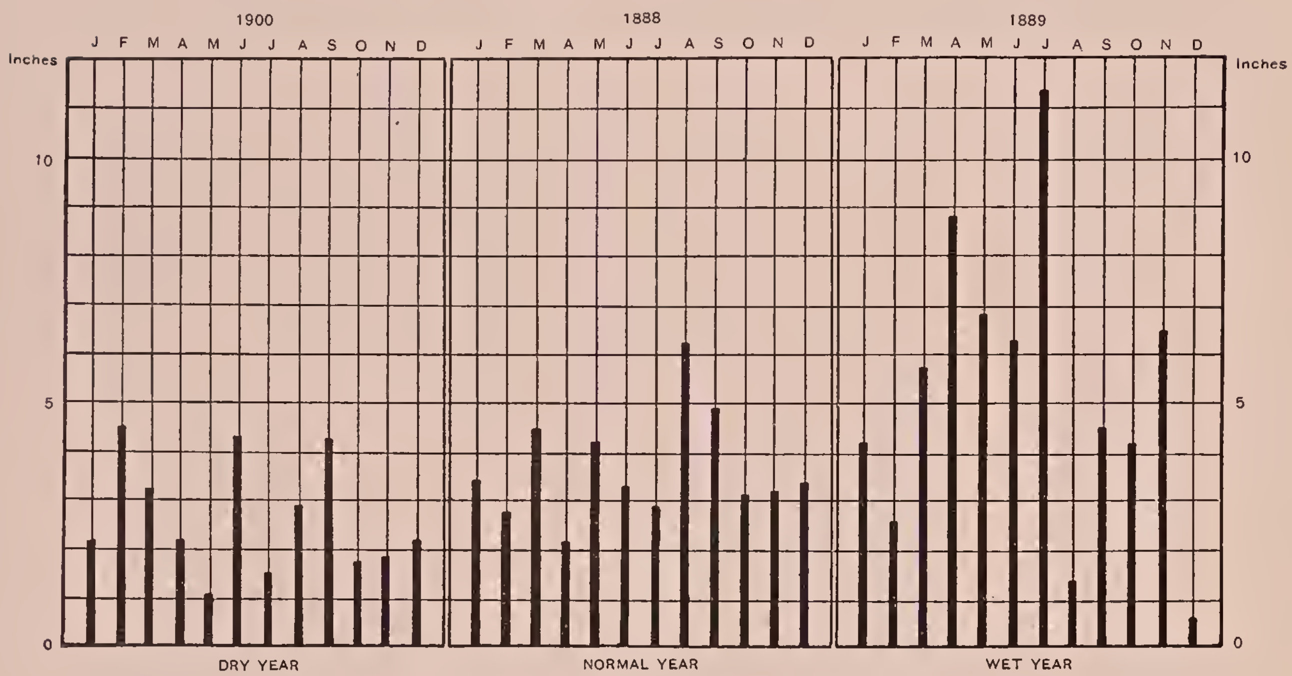

FIG. 15.—Total monthly precipitation during Dry, Normal, and Wet years.

FREQUENCY OF PRECIPITATION OF STATED AMOUNTS IN DAYS.
(Average for 33 years.)

Precipitation in hundredths of an inch.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Trace *	3.4	2.5	3.6	2.9	4.6	3.0	4.0	3.6	2.2	2.8	2.9	2.8	38.3
0.01 to 0.10	5.4	4.8	5.0	4.7	4.8	4.1	5.0	4.7	3.8	4.7	4.1	5.3	56.3
0.11 to 0.25	2.4	2.0	3.5	2.7	2.5	1.7	2.2	1.9	1.4	1.3	2.1	1.8	25.4
0.26 to 0.50	2.1	2.1	1.9	1.8	2.2	2.0	1.5	1.8	1.5	1.5	1.8	1.9	22.1
0.51 to 1.00	1.5	1.6	1.7	1.3	1.6	1.7	1.4	1.5	1.4	1.2	1.5	1.0	17.4
Over 1.00	0.5	0.8	0.9	0.6	0.8	0.8	1.4	1.2	1.2	0.7	0.7	0.9	10.4
.01 and over	11.9	11.3	13.3	11.0	11.8	10.5	11.5	11.1	9.1	9.3	10.0	10.9	131.4

*Average for 20 years.

WINDS.

The prevailing winds in Maryland are northwesterly in winter and during the summer months blow from a southerly direction, more generally from the southwest. The following table shows the prevailing wind direction for the several divisions for the past seven years:

PREVAILING WINDS.

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July	Aug.	Sep	Oct.	Nov.	Dec.
Western section	N W.	N W.	SW	Var.	S W.	Var.	Var.	S W.	Var.	Var.	Var.	S W.
N. Central section	N W.	N W.	N W.	N W.	Var.	Var.	S W.	S W.	Var.	N W.	N W.	N W.
Southern section	N W.	N W.	N W.	Var.	Var.	Var.	S W.	S W.	Var.	N W.	N W.	N W.
Eastern section	N W.	N W.	N W.	Var.	Var.	S W.	S W.	Var.	Var.	N W.	N W.	N W
Entire state	N W.	N W.	N W.	N W.	Var.	Var.	S W.	S W.	Var.	N W.	N W.	N W.

The direction of the wind depends upon the relative positions of the pressure areas with respect to each other and to Maryland. The velocity of the wind is determined by the intensity of the atmospheric disturbances. The only satisfactory records of the wind velocities for the State are those that have been made at Baltimore and Washington. The average monthly, daily and hourly, velocities of the wind, in miles, for Baltimore during twenty-eight years are given in the table below:

AVERAGE MONTHLY, DAILY AND HOURLY WIND MOVEMENT AT BALTIMORE.

AVERAGE.	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.
Monthly	4609	4506	5499	5038	4636	4284	4147	3787	3931	4376	4413	4492
Daily	149	161	177	168	150	143	134	122	131	141	147	145
Hourly	6.2	6.7	7.4	7.0	6.2	6.0	5.6	5.1	5.5	5.9	6.1	6.0

SUNSHINE AND CLOUDINESS.

There is in all seasons of the year an abundance of sunshine. The amount varies considerably in different months but in all months the average is above 50 per cent of the possible amount. January and December have the smallest amount in actual number of hours as well as in the percentage of the possible amount. At Baltimore the amount increases from 4.8 hours in December to a maximum of 9.2 hours in June per day. September, with but 8.1 hours of sunshine has a higher percentage than June, the values being respectively 65 per cent and 62 per cent.

The average monthly amounts of sunshine at Baltimore are shown by the following figures:

AVERAGE DAILY SUNSHINE AT BALTIMORE.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Average in Hours.........	4.9	6.4	6.8	7.9	7.7	9.2	9.1	8.6	8.1	6.8	5.5	4.8	7.2
Percentage of possible amount..	50	59	57	60	54	62	62	63	65	60	51	50	58

Grouping all days of the year into clear days during which less than four-tenths of the sky is covered with clouds, cloudy days, with more

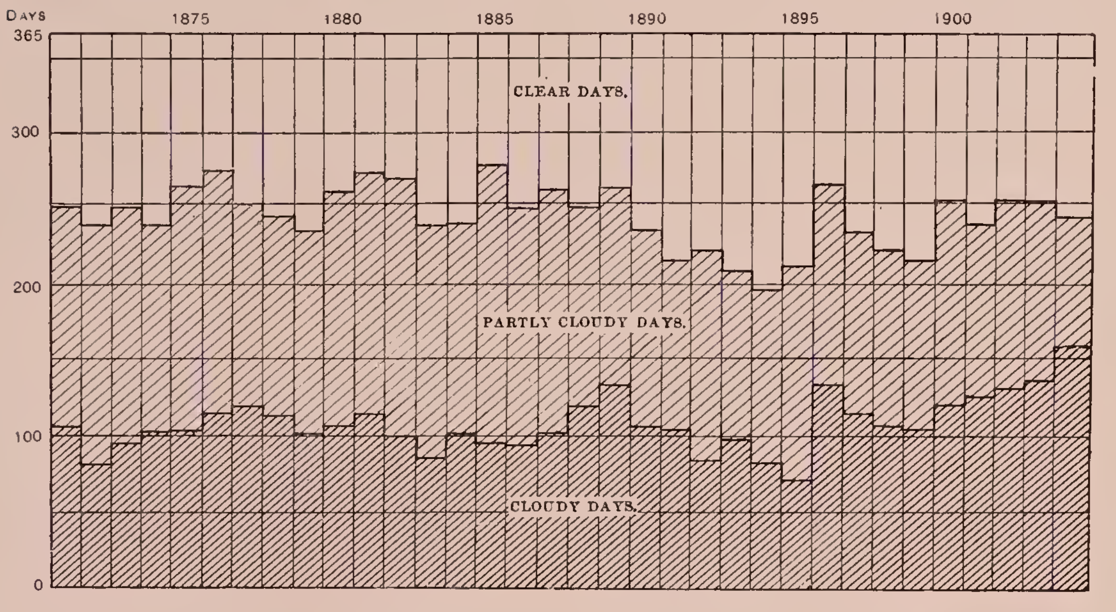

FIG. 16.—Relative Frequency of Clear, Partly Cloudy, and Cloudy days.

than seven-tenths cloudiness, and partly cloudy days with four to seven-tenths cloudiness, we have the following annual distribution at Baltimore:

CLOUDINESS AT BALTIMORE.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Clear days........	8.3	8.4	8.8	9.2	9.5	9.0	10.0	10.7	11.9	12.4	10.2	9.7	118.1
Partly cloudy days.............	12.1	10.9	11.5	11.8	11.6	14.0	13.3	12.9	10.5	10.2	10.2	11.5	140.5
Cloudy days......	10.6	8.9	10.7	9.1	9.9	7.3	7.4	7.4	7.5	8.7	9.6	9.4	106.6

Fig. 16 shows the variation in the distribution of clear, partly cloudy, and cloudy days at Baltimore during the period of 34 years from 1871 to 1904.

HYDROGRAPHY.

The greater part of the State of Maryland lies in the Atlantic drainage, but a small area in the western part of the State is drained by the Youghiogheny River whose waters find their way into the Gulf of Mexico by way of the Ohio River. The most important drainage areas within the State are as follows: (1) the Youghiogheny River drainage, which includes the greater part of Garrett County, (2) the Potomac River drainage, which includes Allegany, Washington, and Frederick counties, and portions of Garrett, Carroll, Montgomery, Prince George's, Charles, and St. Mary's counties, (3) the western Chesapeake Bay drainage, which includes Harford, Baltimore, Anne Arundel, Calvert, and Howard counties, and portions of Cecil, Carroll, Montgomery, Prince George's, Charles, and St. Mary's counties, (4) Eastern Chesapeake Bay drainage, which includes Kent, Queen Anne's, Talbot, Caroline, Dorchester, Wicomico, and Somerset counties, and portions of Cecil and Worcester counties, (5) the direct Atlantic Ocean drainage, a small area in Worcester County in which the streams flow directly into the Atlantic Ocean or its tributaries. On the accompanying map the outlines of the several basins are shown.

Most of the streams of the State belong to one of two types, although there are some streams which exhibit the characteristics of both types in different portions of their courses. One type is found west of a northeast-southwest line, known as the "fall line," extending across the State through Elkton, Baltimore, and Washington. Here the streams have fairly steep slopes and flow over rocky beds. Their courses lie through a rolling country in which hard rocks prevail. Rapids and gorges are of frequent occurrence and there are many opportunities for water-power development. Some of these have been utilized, but there are still many available power sites that are capable of yielding a large amount of horsepower. Much study has been given to this region, the

Hydrographic Division of the U. S. Geological Survey materially aiding the local organizations in the study of the district. Particular attention has been given to the drainage basins of the Potomac and Susquehanna rivers and their tributaries as well as to the Gunpowder, Patapsco, and Patuxent rivers. Stream measurements have been made in many instances over a term of years so that the variations in the stream flow are fairly well known. This is important for future developments on these streams and the data secured are frequently called for by those seeking information for water-power sites and for municipal supply.

Fig. 17.—Map of Maryland showing Drainage Basins.

East of the "fall line" the streams and the topography and geology have a different character. Here the country is less rolling and the surface formations are unconsolidated sands and clays. The streams flow sluggishly in winding courses and in the lower counties open out and become estuaries of the Chesapeake Bay. Here also the streams are navigable in their lower courses, but owing to the slight velocity they split up rapidly in places, and on many streams the head of navigation is several miles farther down stream than it was a half century ago. As a result of the general flatness of the country there are no water-power

FIG. 1.—THE YOUGHIOGHENY NEAR OAKLAND, GARRETT COUNTY.

FIG. 2.—THE POTOMAC AT WILLIAMSPORT, WASHINGTON COUNTY.

VIEWS OF MARYLAND HYDROGRAPHY.

sites in this section. In this area also a smaller proportion of the rainfall finds its way into the streams, as the loose porous soil, most of which is cultivated, absorbs the water very quickly.

As there are no natural lakes of importance in the State there is no regularity in the stream flow such as would exist if there were storage reservoirs on the headwaters of the streams. The flow of the streams varies according to the rainfall. In areas that are highly cultivated the rainwater runs off quickly and the streams rise rapidly at times of large precipitation. In wooded areas the water is held back and reaches the streams more gradually. The highest water generally occurs in the spring months when the snow and ice melts, the ice carried by the large streams, especially the Potomac and Susquehanna, frequently gorging and causing extensive floods.

TERRESTRIAL MAGNETISM.

The wide-spread interest being taken at present in the investigations of the various phenomena manifested by the earth's magnetism and the important bearings such researches have both from a practical as well as a scientific standpoint on many of the questions confronting the Maryland Geological Survey induced that organization to conduct a magnetic survey on a scale not hitherto attempted in this country and exceeded by but one country abroad, viz., Holland.

The practical need of an accurate magnetic survey is at once recognized when it is recalled that a compass not only does not point to the true north but makes an angle varying from place to place, this angle at any one place furthermore being subject to fluctuations of various kinds of sufficient importance to be taken into account by the surveyor in the determination of land boundaries.

In order to contribute the necessary data for the successful determination of the causes producing the changes in the compass direction and to furnish the means of obtaining the extent, distribution, and depth of rocks which cause the so-called "local magnetic disturbances," the magnetic survey of Maryland included also in its operations the determination of the angle of dip of a magnetic needle and the strength of the earth's magnetic force.

Furthermore, true north and south lines were established and defined by well-placed monuments at all of the County Seats in fulfillment of the statute laws of Maryland. The highly useful purpose of such lines, enabling surveyors to readily test, compare, and correct their compasses, has been generally conceded and appreciated.

To make the magnetic data obtained still more useful, a compilation of previous observations was undertaken in co-operation with the United State Coast and Geodetic Survey, so that it is possible at short notice to supply to those interested the amount of change in the compass direction since the year 1700 for all parts of Maryland with sufficient precision for all ordinary needs. Extensive use has been made by surveyors and lawyers of this valuable fund of information.

Two tables are annexed, the first giving the compass direction at Baltimore for every tenth year since 1700, from which it is possible to calculate the amount of change between any two given dates. This table shows that from 1700 to about 1800 the north end of the compass needle steadily moved toward the east, so that instead of pointing nearly 6° to the west of north as it did in 1700 it diverged only about 40′ to the

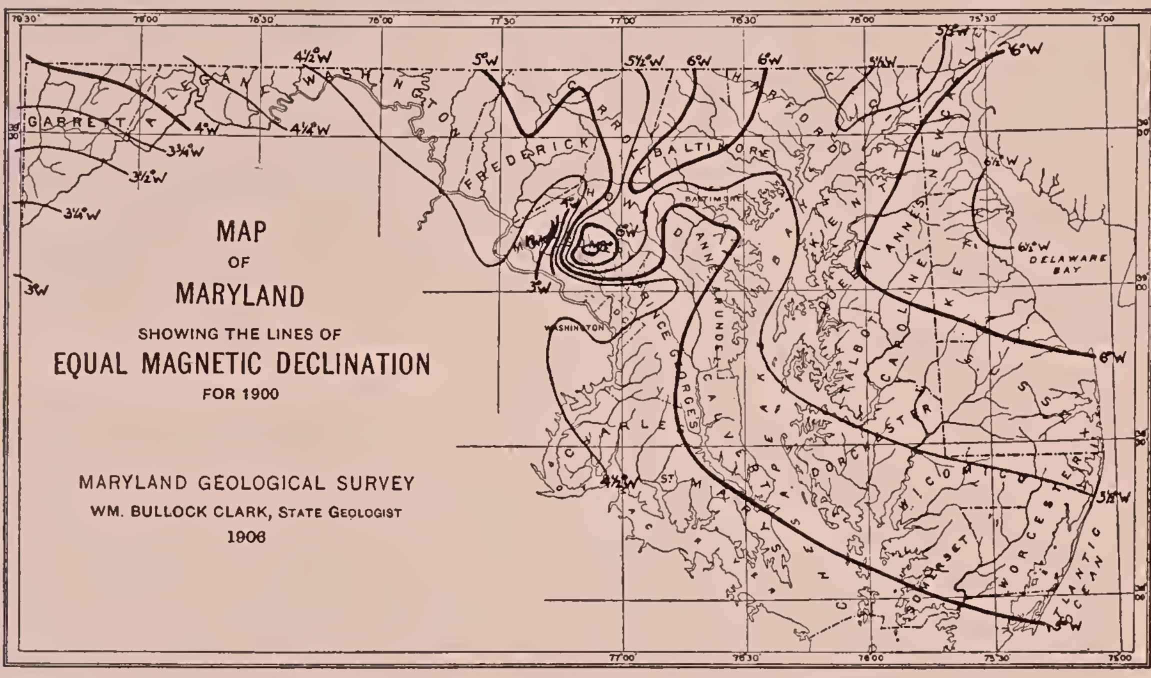

FIG. 18.—Map of Maryland showing lines of Equal Magnetic Declination.

west at the close of the eighteenth century. It will be noticed that beginning with the nineteenth century the north end of the compass began to move towards the west by an ever-increasing amount until at the present it points in the same direction as it did about 200 years ago.

What mysterious cause produces a change in the compass direction large enough to seriously affect land surveys if not taken into account? If a street a mile long has been laid out in Baltimore in 1800 so as to run in the direction indicated by the compass at that time, its northern terminus would have been found nearly one-tenth of a mile too far east as judged by the compass direction in 1905. Furthermore, over how long a period do these progressive changes extend? Neither of these questions can as yet be answered, nor is there any chance that they will ever be solved unless every state and every country make an energetic and systematic attempt to accumulate the necessary data. The example set by Maryland has already been followed to a greater or less extent by the states of North Carolina and Louisiana. Previous to the work of the Maryland Geological Survey, Professor Francis E. Nipher of St. Louis made a most commendable attempt during the years 1877-81 at a carefully executed magnetic survey of Missouri, but for lack of support from the state was prevented from completing the work. Since then the U. S. Coast and Geodetic Survey has made magnetic observations at a number of stations in Missouri, but there still remains much to be done if the completeness with which the Maryland work was undertaken be striven for.

TABLE I. SHOWING HOW THE COMPASS NEEDLE CHANGED ITS DIRECTION EACH DECADE BETWEEN 1700 AND 1905 IN BALTIMORE.

Year (Jan. 1)	North end of compass pointed west of north.	Year (Jan. 1)	North end of compass pointed west of north.	Year (Jan. 1)	North end of compass pointed west of north.	Year (Jan. 1)	North end of compass pointed west of north.
1700	5° 49′	1750	2° 52′	1800	0° 40′	1850	2° 25′
1710	5 27	1760	2 13	1810	0 41	1860	3 05
1720	4 54	1770	1 38	1820	0 52	1870	3 45
1730	4 14	1780	1 08	1830	1 15	1880	4 26
1740	3 34	1790	0 48	1840	1 50	1890	5 04
1750	2 52	1800	0 40	1850	2 25	1900	5 36
						1905	5 51

The second table shows how the compass direction changes in Maryland in the course of the day, both for a winter month and a summer month. The tabular figures give the correction to be applied to the direction of the compass for every hour between 6 a. m. and 6 p. m. in order to correspond with the average direction which the compass would assume in the course of 24 hours, from midnight to midnight. For example, at Baltimore the north end of the compass pointed on the average during the summer of 1905, 5° 53′ west of north. About 8 o'clock in the morning it pointed 5′ less, hence 5° 48′, and between 1 and 2 p. m. about 5′ more or 5° 58′. The angular change of 10′ in the compass direction between morning and afternoon corresponds to a linear change of 15 feet at the distance of a mile. It will be seen that in winter the change between morning and afternoon is only about one-half of that in the summer.

In addition to the regular and progressive changes shown by these two tables, the compass is subject to a number of other fluctuations of a more or less periodic character which, however, are subordinate in amount to those taking place during the day. At times and especially during periods of increased sun-spot activity, as is the case at present, the compass needle may be suddenly deflected by as much as one to three degrees and continue for some time in such violent agitation as to be useless for the time being. Such fluctuations are being photographically registered at the various magnetic observatories maintained by the U. S. Coast and Geodetic Survey, one of these being at Cheltenham, Maryland, and another at Baldwin, Kansas.

TABLE II. SHOWING HOW THE COMPASS NEEDLE CHANGES ITS DIRECTION DURING THE DAY IN MARYLAND.

Month	A. M.						Noon	P. M.					
	6	7	8	9	10	11		1	2	3	4	5	6
	′	′	′	′	′	′	′	′	′	′	′	′	′
January	−0.1	+0.2	+1.0	+2.1	+2.4	+1.2	−1.1	−2.5	−2.6	−2.1	−1.3	−0.2	+0.2
July	+3.1	+4.6	+4.9	+3.9	+1.8	−1.2	−3.4	−4.4	−4.7	−4.2	−2.8	−1.3	−0.3

With the knowledge of such facts as here related, there is a noticeable tendency in Maryland towards the employment of more accurate methods and instruments than were previously used in land surveys.

The map included in this article enables one to tell at a glance what angle the compass makes with a true north and south line in any part of Maryland. Similar maps published in the Survey volumes show the dip of the magnetic needle and the strength of the magnetic force throughout the State. The three maps bear common testimony to the very irregular distribution of the earth's magnetism over central Maryland. The local disturbances in these regions have been definitely referred to certain magnetic rocks and it has been shown that the information thus obtained by means of the magnetic needle can usefully supplement the data acquired from a purely geological survey. On the average there is one magnetic station in the State to every 100 square miles. The latest magnetic survey of England embraced one station on the average to every 139 square miles, while that of Holland had one station to every 40 square miles.

In addition to the magnetic work described above the services of the Maryland Geological Survey were twice called into requisition in this connection in the accurate determination of two important boundary lines. First in 1897 when by order of the Supreme Court of the United States the State of Maryland was requested to make a survey of the line which it claims as its western boundary and next in 1898 to trace a difficult boundary line between the two counties, Allegany and Garrett. This work, as well as that of the Magnetic Survey, was entrusted to a special "Division of Terrestrial Magnetism" and placed in charge of Dr. L. A. Bauer, who is now directing the extensive magnetic survey work being done under the auspices of the U. S. Coast and Geodetic Survey and the Carnegie Institution of Washington.

FORESTRY.

The total area of woodland in Maryland comprises about two and one-half million acres, constituting approximately forty per cent of the total land area of the State. Something less than one per cent of the wooded area is virgin forest. The forests of the State are mostly second growth and under 150 years in age. In the western part of the State there is much recently culled and cut-over virgin forests with little second growth as yet, or covered with a very small brush growth under 25 feet in height.

The general forest conditions which prevail in Maryland can best be described separately for each of the three physiographic divisions which compose the area of the State: (1) the Appalachian Region; (2) the Piedmont Plateau; (3) the Coastal Plain.

The Appalachian Region.

The Appalachian Region is the most heavily wooded region of the State and the lumber industry is here of first importance. The region supplies much lumber for the general market besides the large quantity consumed locally in mines, pulp mills, and for building purposes. About 60 per cent of the area of this division, or some 750,000 acres, is woodland.

The elevation of this region is 500 to 3400 feet above the sea, forming a mountainous country of deep valleys and high ridges. The upper slopes and ridges are unsuited for agriculture and it is not probable that, to any extent, additional areas of forest will be cleared for farming purposes as the best lands are already cleared and many acres once cultivated are being abandoned on account of their poor soil.

The forests of this region consist mostly of recently culled and cut-over virgin forest and sufficient time has not yet elapsed for second growth of any size to develop. What little virgin forest there is in

Maryland is located in inaccessible parts of this region. The prevailing growth is deciduous, but this is conspicuously mingled with patches, and often large areas of conifers. The peculiar position of western Maryland, intermediate between North and South, gives the region a forest flora rich in species, there being in all upwards of seventy distinct tree species. Conifers and hardwoods of the middle South and North mingle here almost on the same ground. The important timber trees occurring in the region include among the conifers, white pine, hemlock, spruce, pitch, and shortleaf pines, and among the hardwoods, red, white, and chestnut oaks, chestnut, tulip, poplar, basswood, birch, beech, and maple.

Nearly all the merchantable coniferous trees have already been culled from the forests of this region and the hardwoods are now rapidly being cleaned out under the highly intensive system of lumbering which has lately been inaugurated in the region. Trees of nearly all species down to very small sizes are used for mine props and lagging. The prevailing forest condition is that of cut-over virgin forest, covered with a scattering growth of large, defective trees not suitable for lumber, interspersed with reproduction of hardwood sprouts and seedlings, and occasional patches of coniferous reproduction. The prevalence of fires, following the severe lumbering, has greatly deteriorated the quality of the reproduction and second growth, so that the outlook for a valuable future crop is, at present, not bright.

The outlook for private forest management in this region is not promising, due to the intensive form of lumbering, the prevalence of fires damaging young growth, and the general slowness of tree growth in this mountainous country requiring a very long time for trees to reach maturity. No owners of large timber tracts in this part of the State have as yet taken up the idea of conservative treatment of their woodlands. Forest management in this region could best be carried on by the State rather than by private owners, as the long rotation required in this section to mature timber would not be as objectionable to the former as to the latter. There is an increasing amount of cut-over land in this section, non-agricultural, and suitable only for growing trees, which will not have a second valuable crop of timber for fifty to seventy-five years, and then only if properly managed. There is no very great inducement to the individual to properly care for such forest land with the harvest so far off, while if managed by the State the welfare of the next generation would be considered and the forest earefully handled aceordingly.

There are some wood-lots in this region, adjacent to farms, and for such small tracts, private forest management will be advisable. At present, however, not such intensive forestry will be praetieable for these wood-lots, as for those in the Piedmont section where the land is more valuable and timber mueh more searee. But the farmers here should always try to keep out fire and improve their lots by thinning out worthless and hindering material as far as it ean be done without finaneial outlay.

The Piedmont Plateau.

The Piedmont Plateau is a fertile region of rolling hills with a general variation in altitude from 100 to 1000 feet above the sea and extends from the Appalachian Region to the Coastal Plain. It is the most lightly-wooded part of Maryland, and the lumber industry here is of very slight importanee. It is estimated that about twenty-five per eent of the region is woodland, or some 700,000 acres.

There are no large timber tracts in this region and the forest area is almost exelusively made up of farmer's wood-lots, or small tracts, for the most part under 100 acres in area. The forest is seeond-growth hardwoods with oak, chestnut, hickory, tulip, poplar, and maple the prevailing trees. It is mostly of sprout origin under 100 years in age. There is also some old-field growth serub pine in this region. These wood-lot forests are in fairly good condition as eompared with the heavily-culled and burned-over forests of the Appalachian Region. As the forest areas are usually small and much broken up by fields, pastures, and roads, extensive forest fires do not occur. However, all the wood-lots now produee mueh less timber than they are eapable of produeing if properly managed. The forest is usually under-stocked, due to frequent random culling out of timber as needed instead of systematic cutting.

The wood-lot is an indispensable adjunct to a well-equipped farm, to furnish the necessary supply of cordwood consumed, fence posts, and rails, and for a hundred and one other purposes, all requiring that there be a wood-lot convenient. The farmer's wood-lot furnishes one of the best possible opportunities for economical forest management. The farmer has the best chance to bring his wood-lot up to the highest possible productive state by utilizing his leisure time during the winter to work in his wood-lot and improve it. He can usually find use for inferior and defective trees, which should be removed for the benefit of the trees remaining; it will, in short, pay him to make improvement cuttings. The more valuable the land occupied by wood-lot is for agriculture, the more intensive should be the forest management in order to realize a reasonable rate of interest on the capital represented by the land. Where the reproduction and second growth following clear cutting is insufficient, the natural reproduction should be supplemented by artificial planting or sowing, in order that the future stand be fully stocked and produce a high yield of timber. The farmer will, in the end, be abundantly repaid if he thus uses his spare time in the improvement of his wood-lot.

Timber brings a good price in this section because of its scarcity, especially such species as chestnut, oak, walnut, and hickory. The growing of chestnut for poles and ties is an especially good proposition as shown by the bulletin of the U. S. Forest Service on the subject.

The Coastal Plain.

The Coastal Plain is fairly heavily wooded and the lumber industry is here of considerable importance but almost exclusively in the manufacture of lumber for local consumption and not, to any extent, for the general market. It varies in elevation from sea level to somewhat over 250 feet, although much of the area, especially on the Eastern Shore, is less than 20 feet above tide. It is estimated that forty per cent of the region is wooded, or over 1,000,000 acres, practically all of which is second growth under 150 years in age. Before the Civil War a much larger per cent was cleared and worked as farm land than at present, but since that time much of it has been abandoned and has grown up, for the most part, to a thick growth of scrub or loblolly pine.

The forests of this region occur in much larger bodies than in the Piedmont Plateau, but there are no such immense continuous tracts as are found in the Appalachian Region. The lumbering here is characterized by an abundance of small sawmills, many portable, in contradistinction from the lumbering in the Appalachian Region which is carried on mostly by a few large operators. The lumbering is mostly of second-growth yellow pine, 40 to 100 years old, which has not had time to attain the large dimensions of virgin timber.

The forests of this region are over half yellow pine, which occurs sometimes in mixture with hardwood but more frequently pure. The species of yellow pine which occur, in order of their importance, are: loblolly, scrub, shortleaf, and pitch. The pine on land over 40 feet in elevation above the sea is prevailingly scrub, and below 40 feet is mostly loblolly.

The rapid growing loblolly and scrub pines in this region which attain merchantable size in thirty to sixty years are good propositions for private forest management, especially the loblolly. Most of the land on which this pine occurs is of little value for agriculture and will often bring better returns from growing timber on short rotations than from crops. In thirty years the scrub pine is valuable for pulpwood; also for charcoal. It is best to cut out the loblolly for lumber as it is sufficiently large in thirty-five to forty-five years.

The outlook of forestry for wood-lots in this section is nearly as good as for the Piedmont region, though timber prices are not usually as high.

In the U. S. Census for 1900 the following figures are given on the lumber industry in Maryland for that year:

Cut of conifers	109,651,000	board feet
Hardwoods	78,306,000	" "
Total	187,957,000	

Value of product	$2,650,082.

Probably about one-half of this production was from the mountain region and one-half from the Coastal Plain with none to speak of from the Piedmont section.

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